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SELECTED WATER RESOURCES ABSTRACTS

VOLUME 12, NUMBER 17
SEPTEMBER 1, 1979

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SELECTED WATER RESOURCES ABSTRACTS

A Semimonthly Publication of the Water Resources Scientific Information Center, Office of Water Research and Technology, U.S. Department of the Interior

VOLUME 12, NUMBER 17
SEPTEMBER 1, 1979

W79-08001 – W79-08500

e Secretary of the U.S. Department of the Interior has de-
mined that the publication of the periodical is necessary in the
nsaction of the public business required by law of this Depart-
ment. Use of funds for printing this periodical has been approved by the Director of the Office of Management and Budget through August 31, 1983.

As the Nation's principal conservation agency, the Department of the Interior has responsibility for most of our nationally owned public lands and natural resources. This includes fostering the wisest use of our land and water resources, protecting our fish and wildlife, preserving the environmental and cultural values of our national parks and historical places, and providing for the enjoyment of life through outdoor recreation. The Department assesses our energy and mineral resources and works to assure that their development is in the best interests of all our people. The Department also has a major responsibility for American Indian reservation communities and for people who live in Island Territories under U.S. administration.

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V.12 No.17-

FOREWORD

Selected Water Resources Abstracts, a semimonthly journal, includes abstracts of current and earlier pertinent monographs, journal articles, reports, and other publication formats. The contents of these documents cover the water-related aspects of the life, physical, and social sciences as well as related engineering and legal aspects of the characteristics, conservation, control, use, or management of water. Each abstract includes a full bibliographical citation and a set of descriptors or identifiers which are listed in the **Water Resources Thesaurus.** Each abstract entry is classified into 10 fields and 60 groups similar to the water resources research categories established by the Committee on Water Resources Research of the Federal Council for Science and Technology.

WRSIC IS NOT PRESENTLY IN A POSITION TO PROVIDE COPIES OF DOCUMENTS ABSTRACTED IN THIS JOURNAL. Sufficient bibliographic information is given to enable readers to order the desired documents from local libraries or other sources.

Selected Water Resources Abstracts is designed to serve the scientific and technical information needs of scientists, engineers, and managers as one of several planned services of the Water Resources Scientific Information Center (WRSIC). The Center was established by the Secretary of the Interior and has been designated by the Federal Council for Science and Technology to serve the water resources community by improving the communication of water-related research results. The Center is pursuing this objective by coordinating and supplementing the existing scientific and technical information activities associated with active research and investigation program in water resources.

To provide WRSIC with input, selected organizations with active water resources research programs are supported as "centers of competence" responsible for selecting, abstracting, and indexing from the current and earlier pertinent literature in specified subject areas.

Additional "centers of competence" have been established in cooperation with the Environmental Protection Agency. A directory of the Centers appears on the inside back cover.

Supplementary documentation is being secured from established discipline-oriented abstracting and indexing services. Currently an arrangement is in effect whereby the Bio-Science Information Service of Biological Abstracts supplies WRSIC with relevant references from the several subject areas of interest to our users. In addition to Biological Abstracts, references are acquired from Bioresearch Index which are without abstracts and therefore also appear abstractless in SWRA. Similar arrangements with other producers of abstracts are contemplated as planned augmentation of the information base.

The input from these Centers, and from the 51 Water Resources Research Institutes administered under the Water Resources Research Act of 1964, as well as input from the grantees and contractors of the Office of Water Research and Technology and other Federal water resource agencies with which the Center has agreements becomes the information base from which this journal is, and other information services will be, derived; these services include bibliographies, specialized indexes, literature searches, and state-of-the-art reviews.

Comments and suggestions concerning the contents and arrangements of this bulletin are welcome.

Water Resources Scientific Information Center
Office of Water Research and Technology
U.S. Department of the Interior
Washington, DC 20240

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03 WATER SUPPLY AUGMENTATION AND CONSERVATION
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ABSTRACT SOURCES

SELECTED WATER RESOURCES ABSTRACTS

2. WATER CYCLE

2A. General

ELECTROLYTIC METHOD FOR MEASURING FLOW VELOCITY,
For primary bibliographic entry see Field 7B.
W79-08144

PREDICTION OF DRAINAGE DENSITY FROM SURROGATE MEASURES,
Hull Univ. (England). Dept. of Geography.
For primary bibliographic entry see Field 7C.
W79-08265

TERRACES IN ARID STREAM VALLEYS. A PROBABILITY MODEL,
Hebrew Univ. Jerusalem (Israel). Inst. of Earth Sciences; and Clark Univ., Worcester, MA. School of Geography.
A. P. Schick, and D. Magid.
Catena, Vol. 5, No. 3/4, p 237-250, Dec. 1978. 5 fig, 7 tab, 9 ref.

Descriptors: *Stochastic processes, *Probability, *Model studies, *Computer models, *Terraces(Geologic), Analytical techniques, Mathematical models, Floods, Streambeds, Deserts.

A stochastic model for the number of terraces in a desert stream valley has been developed which enables the generation by computation of a time series of the number of terraces which occur at a given valley cross section depending upon the efficiency of major 'super floods' in the obliteration of these terraces. The purpose of the study was to further develop the empirical probabilities of any number of terraces by working with a longer time series, establish expected theoretical probabilities, and suggest some model alterations, directions and additional uses for future studies in light of some geomorphic implications. On a theoretical basis it is shown that of the number of super floods necessary for obliteration is one, the probability of having no terrace is one third and of having one terrace is two thirds. Model procedures have been described in detail previously (Schick, 1974) and the present paper briefly summarizes this earlier work with emphasis on recent changes and amplifications. (Tickes-Arizona)
W79-08359

HYDROLOGIC DATA FOR WATER-TABLE AQUIFERS IN THE GREATER DENVER AREA, FRONT RANGE URBAN CORRIDOR, COLORADO,
Geological Survey, Lakewood, CO. Water Resources Div.
D. E. Hillier, P. A. Schneider, Jr., and E. C. Hutchinson.
Availability: OFSS, USGS Box 25425, Fed. Ctr. Denver, CO. 80225. Price: Paper copy, $14.25, Microfiche, $4.25. Geological Survey open-file report 79-214, January 1979. 68 p, 2 fig, 1 plate, 4 tab, 5 ref.

Descriptors: *Groundwater resources, *Aquifers, *Water wells, *Water levels, *Water quality, Springs, Well data, Water table aquifers, Colorado, *South Platte River basin, Denver area(Colo).

As part of the U.S. Geological Survey's investigations of the hydrology and geology in the Front Range Urban Corridor of Colorado, hydrologic data for water-table aquifers in the greater Denver area were collected and compiled during 1976-77. These data, consisting of records for 325 wells and 11 springs and chemical analyses of water for 272 of the wells and all 11 springs, are presented in tabular form. The tables contain data that were collected during the investigation, data compiled from reports published by the Colorado Water Conservation Board and the U.S. Geological Survey, and unpublished data from the files of the U.S. Geological Survey. State and local officials in the greater Denver area may find these data useful in planning for residential, commercial, and industrial development. (Woodard-USGS)
W79-08394

WILLAMETTE BASIN COMPREHENSIVE STUDY OF WATER AND RELATED LAND RESOURCES: APPENDIX B--HYDROLOGY,
Pacific Northwest River Basins Commission, Portland, OR. Willamette Basin Task Force.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A036 747, Price codes: A11 in paper copy, A01 in microfiche. Chaired by the U.S. Geological Survey, 1969, 165 p, 36 tab, 47 fig, 21 maps, 23 photos.

Descriptors: *Hydrology, *Water resources, *Planning, *Groundwater, *Groundwater availability, *River basin development, *Willamette River(OR), Oregon, Geohydrologic units, Surface water availability, Hydrologic data, Glaciohydrology, Hydrologic aspects, Hydrologic budget, Hydrologic cycle, Climate, Water supply, Watersheds(Basins), Climatic data, Regional analysis, Data collections, Surface-groundwater relationships, Legal aspects, Water rights, Storms, Water resources development, Water quality, River basins.

The study was undertaken to plan for the proper development of water and related land resources of the Willamette Basin in Oregon. Appendix B, along with Appendices A and C, provides supporting data for the functional Appendices D through L. Climate is first discussed, including the climatic significance of geographical features such as the Pacific Ocean, the Columbia Gorge, and the Coast and Cascade Ranges, climatic elements (e.g., temperature, precipitation, evaporation), and meteorological aspects of major storms--rain, wind, and snow. A description of water resources, their distribution, and their variation at different times are presented. These resources are described in terms of factors influencing the occurrence of water. Specifically reviewed here are surface waters, groundwater, the relationship between surface and groundwater, management programs, and water rights and legal restrictions. Lastly, the adequacy of hydrologic data is reviewed. Statistical and interpretive hydrologic data necessary for broad-scale water resources planning are provided. Data assembled are those concerning climate, streamflow, lakes and glaciers, chemical-quality, sediment, stream temperature, and groundwater. Geologic and soils mapping are briefly discussed, and a list of references is provided. (See also W79-08433) (Zayac-NC)
W79-08435

2B. Precipitation

LATE CENOZOIC PALAEOENVIRONMENTS ON THE WEST COAST OF SOUTH AFRICA,
South African Museum, Cape Town.
A. J. Tankard, and J. Rogers.
Journal of Biogeography, Vol. 5, No. 4, p 319-337, December 1978. 5 fig, 3 tab, 80 ref.

Descriptors: *Coasts, *Paleoclimatology, *Quaternary period, *Climatic change, *Atmospheric physics, History, Meteorology, Paleohydrology, Miocene epoch, Cenozoic era, Tertiary period, Climatology, Air circulation, Synoptic analysis, South Africa, Coastal deserts, Anticyclones, Weather patterns.

Widespread aridity on the western coast of South Africa is related to upwelling of cold subsurface waters. Physical, chemical, and biological attributes of Tertiary and Quaternary strata suggest that this aridity has developed progressively since the Miocene. The present study of this littoral, describing the development of desiccation through the late Cenezoic, points out the relative youthfulness of the Namib Desert and shows evidence of late Pleistocene climatic changes. Age correlations relate these paleoclimatic events to the history of the Southern Ocean and Antarctic Ice Cap, indicating that aridity was initiated in the late Tertiary but only fully established in the Quaternary. Climatic belts expanded poleward during the late Pleistocene hyperthermal, and greater aridity in the Southwestern Cape at that time is attributed to the increased influences of trade winds and the poleward shift of westerlies. Conversely during the succeeding hypothermal a 5 degree equatorward shift of anticyclone tracks and climatic belts enabled westerly winter rainfall to reach latitude 23 degrees S. During this time ephemeral rivers on the Namaqualand Coast were rejuvenated, palaeolakes filled during the later half of the last major sea level regression, and the arid zone moved equatorward. Atmospheric circulation and probably aridity are speculated to have been more intense at this time in the arid core of the north than they are today. (Tickes-Arizona)
W79-08023

ANALYSIS OF ANNUAL RAINFALL OF RAJASTHAN DESERT,
Udaipur Univ. (India). Soil and Water Conservation Engineering.
J. F. Correia.
Transactions of Indian Society of Desert Technology and University Centre of Desert Studies, Vol. 2, No. 2, p 158-165, Dec 1977. 4 tab, 5 fig, 7 ref.

Descriptors: *Rainfall disposition, *Statistical methods, *Frequency analysis, *Forecasting, *Climatic data, *Time series analysis, Regression analysis, Rajasthan Desert, India, Droughts, Water shortage.

The 78 year rainfall record (1891-1968) of the 11 western districts in the arid region of Rajasthan is analysed here, the 10-year progressive mean is plotted, and an equation derived for the prediction of annual rainfall in the area. Mean annual rainfall of the region, averaged arithmetically for 78 years, was 367.9 mm with the ratio of maximum to minimum varying from 5.8 to 94.0 depending upon district. A close examination of the 10-year progressive mean indicates that it follows a typical decay curve in which the 10-year moving average curve represents a series of progressive harmonic waves with varying successive periods of 15, 13, 5, 6, 6, 12, and 12 years. The lognormal distribution is found to be in close agreement with the observed data and is used here to predict average annual rainfall probabilities and recurrence intervals with reasonable confidence. Rainfall in this arid region is erratic and unpredictable, with only 10% of the years being normal, and nearly 1 out of 2-1/2 years receiving highly deficient rainfall. (Tickes-Arizona)
W79-08026

SIX-MINUTE RAINFALL INTENSITY DATA FOR AN EXCEPTIONALLY HEAVY TROPICAL RAINSTORM,
Queensland Dept. of Forestry, Atherton (Australia).
D. A. Gilmour, and M. Bonell.
Weather, Vol. 34, No. 4, p 148-158, April 1979. 5 fig, 4 tab, 7 ref.

Descriptors: *Rainfall intensity, *Demonstration watersheds, *Australia, *On-site investigations, Small watersheds, Rainfall, Tropical regions, Measurement, On-site data collections, Synoptic analysis, Storms, Foreign research, Temporal distribution, *Babinda(Australia), *Queensland(Australia).

The object was to give details of 6-minute rainfall intensities for an exceptionally heavy storm event which took place in a 25 ha catchment of tropical rainforest in north-east Queensland, Australia. The experimental area is located 5 km east of Babinda (17 deg 20 min S) adjacent to the Coral Sea and in the midst of the wet tropical coastal belt of north-east Queensland. The catchment has recorded a mean annual rainfall of 4239 mm for the 8-year period 1970 to 1977. The weekly maximum 6-minute intensities were evaluated for the 1976 'wet season' for the purposes of statistically relating precipitation to overland flow generation in the tropical rainforest catchment. The storm under investigation occurred in December 1976 and generated the highest short-term intensities since records commenced. A detailed breakdown of 6-minute intensities was tabulated. High, short-term rainfall intensities were demonstrated for an event typical of the severe flood-producing rains which are experienced on the north tropical coast. While

it was certainly a major storm event, it was by no means extreme, as the nearby town of Babinda has recorded several daily falls in excess of 500 mm. When the length of the catchment record is sufficient, it is intended to produce a frequency-amount-duration analysis for various periods ranging from 6 min to 24 hrs. (Humphreys-ISWS)
W79-08123

ON THE EFFECT OF PRECIPITATION AND RUNOFF ON COASTAL CIRCULATION IN THE GULF OF ALASKA,
Alaska Univ., Fairbanks. Inst. of Marine Science.
For primary bibliographic entry see Field 2L.
W79-08237

ANALYSIS OF RANDOMIZED WINTER OROGRAPHIC CLOUD SEEDING EXPERIMENTS IN UTAH,
Utah Water Research Lab., Logan.
G. E. Hill.
Journal of Applied Meteorology, Vol. 18, No. 4, p 413-448, April 1979. 26 fig, 11 tab, 10 ref. 14-06-D-6820.

Descriptors: *Cloud seeding, *Weather modification, *Utah, *On-site investigations, Precipitation(Atmospheric), Mountains, Networks, Aircraft, Rain gages, Measurement, Temperature, Air temperature, Cloud physics, Meteorology, *Wasatch Mountains(UT).

Analysis was made of two randomized winter orographic cloud seeding experiments conducted in the northern Wasatch Mountains. In the first experiment, seeding material was released from airborne pyrotechnics, and in the second experiment, from three mountain-top generators. Precipitation was measured by a network of remotely interrogated precipitation gages. Interpretation of the results was aided in particular by the use of storm type classifications, precipitation estimators based on upper level data, vertical incidence radar, and aircraft icing reports. An a priori hypothesis, that seeding of clouds would increase precipitation when the 500 mb temperature is warmer than -22 C, was rejected. Also, precipitation increases were not found in orographic clouds when the cloud-top temperature is warmer than -29 C. An a posteriori analysis than-24 C. On the other hand, stratification of experimental events according to degree of aircraft icing, as a measure of supercooled water concentration, indicated that marked seeding effects might be present. (Sims-ISWS)
W79-08244

A REANALYSIS OF THE WOLF CREEK PASS CLOUD SEEDING EXPERIMENT,
Washington Univ., Seattle. Cloud Physics Group.
A. L. Rangno.
Journal of Applied Meteorology, Vol. 18, No. 5, p 579-605, May 1979. 21 fig, 6 tab, 23 ref.

Descriptors: *Cloud seeding, *Weather modification, *Rocky Mountain Region, *Colorado, *Utah, *Arizona, *New Mexico, Precipitation(Atmospheric), Rainfall, Snowfall, Water resources, Data processing, Analytical techniques, Climatology, Cloud physics, Meteorology, *San Juan Mountains(CO), *Wolf Creek Pass(CO).

A 6-season, randomized-by-season cloud seeding experiment consisting of 3 seeded seasons and 3 non-seeded seasons was conducted by Colorado State University during the middle and late 1960's in the Wolf Creek Pass region of the San Juan Mountains of southwest Colorado. The results of the seeding have been reported in a series of papers as having produced statistically significant increases in precipitation at Wolf Creek Summit when the 500 mb temperature was warmer than 23C. Furthermore, it has been reported that increases in precipitation produced statistically significant increases in the runoffs from 3 target watersheds when compared to the runoffs from 3 control watersheds. In this paper, the results of the Wolf Creek Pass Experiment (WCPE) were reexamined. It was shown that the 3 non-seeded seasons occurred during meteorological conditions which brought 'warm aloft' (500 mb temperatures warmer than -23C) storm days with unusually light precipitation over a wide region of Colorado, northern New Mexico, southern Utah, and northern Arizona. This bias produced high values of seed/no-seed precipitation ratios at Wolf Creek Summit which led to the misperception of large increases in precipitation due to cloud seeding. It was also shown that nearly all central and southwest Colorado watersheds with similar exposures to the target watersheds for the WCPE had high runoffs during the 3 seeded seasons compared to the 3 control watersheds chosen. Hence, the increases in runoff reported from the 3 target watersheds were part of a large-scale pattern due to natural causes rather than to cloud seeding. (Sims-ISWS)
W79-08246

AN AREAL AND TEMPORAL ANALYSIS OF PRECIPITATION IN THE NORTHEASTERN UNITED STATES,
Rutgers--The State Univ., Brunswick, NJ. Dept. of Meteorology and Physical Oceanography.
C. M. Scott, and M. D. Shulman.
Journal of Applied Meteorology, Vol. 18, No. 5, p 627-633, May 1979. 8 fig, 1 tab, 11 ref.

Descriptors: *Precipitation(Atmospheric), *Northeast U.S., *Maryland, *Massachusetts, *Climatology, Data processing, Anaytical techniques, Statistics, Methodology, Spatial distribution, Temporal distribution, Mapping, Climatic data, Rainfall, Monthly, Snowfall, Meteorology, *Harmonic analysis.

Harmonic analysis, an objective method of analyzing precipitation seasonality, was applied to 1941-70 monthly precipitation normals for nearly 200 stations in the northeastern United States. This analysis presented distribution of the annual precipitation as the sum of 6 different sine curves (harmonics). The first 3 harmonics account for most of the variance in the original precipitation distribution in this area. Maps were presented of percent variance reduction and phase angle, and possible meteorological factors responsible for the observed patterns were suggested. In addition, the results were compared to previous applications of harmonic analysis to monthly precipitation normals during 1921-50 and 1931-60. The greatest difference appeared as a substantial increase in the third harmonic in the coastal region from Maryland to Massachusetts. Variance reductions as high as 73% occurred in the center of this area, compared to a maximum value of only 46% for the 1931-60 normal period. Several possible reasons for this phenomenon were discussed. (Sims-ISWS)
W79-08247

PATH-AVERAGED MEASUREMENTS OF RAIN RATE AND RAINDROP SIZE DISTRIBUTION USING A FAST-RESPONSE OPTICAL SENSOR,
National Oceanic and Atmospheric Administration, Boulder, CO. Wave Propagation Lab.
T-I. Wang, K. B. Earnshaw, and R. S. Lawrence.
Journal of Applied Meteorology, Vol. 18, No. 5, p 654-660, May 1979. 13 fig, 17 ref.

Descriptors: *Rainfall, *Raindrops, *Instrumentation, Measurement, Particle size, Rainfall intensity, Precipitation intensity, Precipitation(Atmospheric), Optical properties, Equipment, Electronic equipment, Engineering, Electrical engineering, Meteorology, Drop-size distributions.

Path-averaged terminal velocity distribution of raindrops was determined from the temporal covariance function of signals from two vertically spaced linear optical detectors that respond to raindrop-induced amplitude scintillations of a projected laser beam. The known monotonic relationship between drop size and terminal velocity permits the measured velocity distribution to be converted to path-averaged drop-size distribution and, in turn, to rain rate. The large capture area of the measurements over a 200 m path allows drop-size distribution to be measured in short time intervals. This paper presented measurements of path-averaged rain rate and raindrop size distribution made at 42 s intervals. The terminal velocity distribution during a storm that contained a mixture of rain and hail clearly showed the two-component nature of the precipitation. (Sims-ISWS)
W79-08249

RAINFALL ALONG THE EAST COAST OF SOUTHERN AFRICA, THE SOUTHERN OSCILLATION, AND THE LATITUDE OF THE SUBTROPICAL HIGH PRESSURE BELT,
University of the Witwatersrand, Johannesburg (South Africa).
T. G. J. Dyer.
Quarterly Journal of the Royal Meteorologial Society, Vol. 105, No. 444, p 445-451, April 1979. 1 fig, 6 tab, 5 ref.

Descriptors: *Rainfall, *Africa, *Australia, *Analytical techniques, Regression analysis, Correlation analysis, Pressure, Atmospheric pressure, Coasts, Weather, Forecasting, Precipitation(Atmospheric), Meteorology, Pressure belts, Southern oscillation.

Eighteen rainfall series within a latitude belt 28 deg 08 min S to 30 deg 25 min S were inspected for relationsnips with Pittock's L index for the latitude of the subtropical high pressure belt (eastern Australia) and the southern oscillation index. Principal components analysis was used to reduce the dimensions of each of the 3 data sets, and the components for the pressure systems were used as independent variables in a step-wise regression analysis. Rainfall components were taken as the dependent variables. Useful relationships exist between rainfall and Pittock's L, but there is no evidence to suggest that the same situation applies for the southern oscillation index. The results agreed with those recently obtained for Mauritius by M. D. Dennett. (Sims-ISWS)
W79-08268

THE PREDICTED ABOVE-NORMAL RAINFALL OF THE SEVENTIES AND THE LIKELIHOOD OF DROUGHTS IN THE EIGHTIES IN SOUTH AFRICA,
University of the Witwatersrand, Johannesburg (South Africa).
P. D. Tyson, and T. G. J. Dyer.
South African Journal of Science, Vol. 74, No. 10, p 372-377, Oct 1978, 5 fig, 3 tab, 23 ref.

Descriptors: *Rainfall disposition, *Depth-area-duration analysis, *Distribution patterns, *Forecasting, Meteorology, Climatic change, Droughts, Data collection, South Africa.

Summer rainfall patterns for northern and eastern South Africa are examined here and estimates of changes based upon the analysis of data for 1910-67 suggesting that during the seventies the region as a whole would experience an extended wet spell are compared with actual changes that occurred in the 1968-1972 period. Results have indicated that while it is not possible to predict actual year-to-year rainfall for particular places of regions as a whole, the prediction of an extended spell of above average rainfall can be made. Additional revised estimates of the likelihood of future wet and dry spells based upon data from 191 stations for the 1910-1977 period are presented and indicate that during dry spells rainfall over most of South Africa was from 80-90% of the mean while during wet spells it varied from 110% to 120% of the mean with the exception of the present spell of the seventies when, for the five years of the spell to date, up to 200% of the mean has been experienced over the Cape interior. (Tickes-Arizona)
W79-08367

2C. Snow, Ice, and Frost

SNOW ACCUMULATION, DISTRIBUTION, MELT, AND RUNOFF,
Army Terrestrial Sciences Center, Hanover, NH.
S. C. Colbeck, E. A. Anderson, V. C. Bissell, A. G. Crook, and D. H. Male.
EOS, Transactions, American Geophysical Union, Vol. 60, No. 21, p 465-468, May 22, 1978. 3 fig, 29 ref.

Descriptors: *Snow, *Snow surveys, *Reviews, Snow cover, Spatial distribution, Snowmelt, Runoff, Movement, Data processing, Water equivalent, Instrumentation, Hydrology, Remote sensing, Model studies, Physical properties, Cold regions, Snowpacks, Flow, Ablation, Albedo, *Research needs.

The authors outlined their ideas about the current status and needs in snow hydrology in order to provide some guidance for the multitude of national and local organizations that are affected by these problems. Subjects discussed included collection and processing of snow survey data, energy exchange at the snow surface, water movement and snow properties, snow accumulation and ablation models, Arctic and subarctic hydrology, and remote sensing. A detailed understanding of the properties and processes of snow is crucial to the development of adequate models of the snow cover to meet the requirements of today's society. However, it is clear that these models can only represent the snow cover through knowledge generated by the appropriate research. It is also clear that the usefulness of these models is greatly limited by the ability to provide the quality and quantity of necessary input data. While major advances are being made in this respect by remote sensing, a large number of 'weak links' have been identified in the system. A particular 'weak link' depends upon the problem being studied, the accuracy desired, the geographical area, and prevailing conditions at that moment. The polar and subpolar regions are special in this regard because of the lack of background data, the harsh environment, and the inaccessibility of many sites. (Humphreys-ISWS)
W79-08078

DRIFTING SNOW SIMILITUDE,
Iowa State Univ., Ames. Dept. of Aerospace Engineering.
J. D. Iversen.
Journal of the Hydraulics Division, American Society of Civil Engineers, Vol. 105, No. HY6, Proceedings Paper 14647, p 737-753, June 1979. 5 fig, 2 tab, 31 ref, 1 append.

Descriptors: *Snow, *Snowpacks, *Model studies, Mathematical models, Laboratory tests, Winds, Sediments, Sediment transport, Physical properties, Dimensional analysis, Saltation, Simulation analysis, Analytical techniques, Wind tunnel tests, Snowdrifts.

The problem of modeling the drifting of snow in a boundary layer wind tunnel was reviewed. The important dimensionless parameters that govern the drifting phenomena were introduced. Theoretical means such as the equations for mass transport rate of saltating material and the particle trajectory equations of motion were used to combine these dimensionless parameters into 5 similitude parameters. These final 5 parameters were analyzed as to their relative importance in the wind tunnel simulation of drifting snow. The properties of snow and of possible modeling materials were examined, and the final results of a previous study involving simulation of sand movement were presented. Use of a variety of model particles and the variation of vertical distortion of the modeled topography can aid in application of the results to full-scale conditions. Quantitative scaling can be achieved by measurement of the rate of accumulation of drifting material. (Sims-ISWS)
W79-08111

ON THE STATISTICAL DISTRIBUTION OF PRESSURE RIDGES IN SEA ICE,
Intera Environmental Consultants Ltd. Ottawa (Ontario).
R. T. Lowry, and P. Wadhams.
Journal of Geophysical Research, Vol. 84, No. C5, p 2487-2494, May 20, 1979. 7 fig, 16 ref. ONR NO 0014-76-C0660, NR307-382.

Descriptors: *Sea ice, *Statistics, *Distribution patterns, Spatial distribution, Data processing, On-site data collections, On-site investigations, Mathematical models, Model studies, Analytical techniques, *Pressure ridges, Ridge spacings, Ridge heights.

Probability distributions for the heights and spacings of sea ice pressure ridges were described and compared with data from airborne laser profiles and submarine sonar profiles. The distributions were based on the variational calculations of Hibler but take into account the effects of finite slope angles of ridges and of the criterion used to identify an independent ridge during computer reduction of data. The modified distributions were shown to give a much better fit for small ridge spacings and slightly better fit for small ridge heights than the 1972 theory. (Sims-ISWS)
W79-08112

DETERMINATION OF THE WATER CONTENT OF SNOW FROM THE STUDY OF ELECTROMAGNETIC WAVE PROPAGATION IN THE SNOW COVER,
Ecole Nationale Superieure d'Electronique et de Radioelectronique et de Radioelectricite de Grenoble (France). Lab. d'Electromagnetisme.
J. Tobarias, P. Saguet, and J. Chilo.
Journal of Glaciology, Vol. 20, No. 84, p 585-592, 1978. 9 fig, 4 ref.

Descriptors: *Moisture content, *Snow, *Mathematical models, *Electromagnetic waves, Snow cover, Measurement, Model studies, Methodology, Analytical techniques, Theoretical analysis, Laboratory tests, Equations.

A method was proposed for measuring in situ and continuously the water content of a sample of snow in the snow cover. This method is based on the measurement of the attenuation of an electromagnetic wave propagating in a sample of snow situated between two antennae, an emitter, and a receiver. The working frequency is 9.4 GHz. (Humphreys-ISWS)
W79-08113

AN INEXPENSIVE TENSIOMETER FOR SNOW-MELT RESEARCH,
Department of the Environment, Ottawa (Ontario). Inland Waters Directorate.
A. Wankiewicz, and J. De Vries.
Journal of Glaciology, Vol. 20, No. 84, p 577-584, 1978. 6 fig, 5 ref.

Descriptors: *Snowmelt, *Tensiometers, *On-site tests, *Instrumentation, Hydrology, Snowpacks, Melt water, Flow, Pore pressure, Water pressure, Measurement, Monitoring.

The construction and use of a rugged and easily installed tensiometer for use in snow hydrology were discussed. The tensiometer incorporates a short (380 mm) water manometer, adequate for the small range of capillary pressure in melting snow. The response of a row of tensiometers to the application of a dyed water pulse to the snow surface was compared to the resulting dye stain pattern. The use of a tensiometer in a snow-pack requires special attention to the following 4 points: (1) the tensiometer must be used only in a wet snow-pack, and care must be taken to prevent freezing of the exposed manometer; (2) the height of the porous cup relative to the manometer scale zero (the zero offset) should be accurately known, a task made more difficult by melting of the snow surface and snow-pit walls; (3) the lateral variation in flow requires the use of many tensiometers if the mean snow-water pressure of a layer is required; and (4) short-wave radiation penetrating the snow from the access snow-pit must be minimized to produce an insignificant change in snow properties in the vicinity of the porous cup. (Humphreys-ISWS)
W79-08114

DISRUPTION OF BEDROCK BY THE GROWTH AND COLLAPSE OF ICE LENSES,
Aberdeen Univ. (Scotland). Dept. of Geography.
G. Thom.
Journal of Glaciology, Vol. 20, No. 84, p 571-575, 1978. 4 fig, 2 tab, 3 ref.

Descriptors: *Ice, *Geomorphology, *Antarctic, *On-site investigations, Explorations, Topography, Shape, Potholes, Petrology, On-site data collections, Collapse, Ice lens, Hummocks.

Hummocks and hollows were found developed in bedrock in the South Shetland Islands, Antarctica. Excavation revealed an ice lens 60 cm thick beneath a hummock. A cycle for the formation of the hummocks and hollows by the growth and collapse of ice lenses was suggested as follows: (1) An ice lens is initiated at a point in the bedrock and begins to grow, heaving up the bedrock which cracks vertically to accommodate the expansion and deformation. (2) As the ice lens grows, the sides of the hummock steepen, enhancing mass wasting and resulting in the removal of material from the hummock. (3) During the winters, the lens increases in size until a threshold is reached when the widening of the crack alters the thermal conductivity of the system to such an extent that the lens is susceptible to melting in subsequent summers. (4) With the melting of the lens, the bedrock collapses and, because of the removal of material from the system, a hollow is produced. (Humphreys-ISWS)
W79-08115

FABRICS OF ICING-MOUND AND PINGO ICE IN PERMAFROST,
Hardy (R. M.) and Associates, Calgary (Alberta).
W. A. Gell.
Journal of Glaciology, Vol. 20, No. 84, p 563-569, 1978. 3 fig, 23 ref.

Descriptors: *Ice, *Permafrost, *Canada, *On-site investigations, Crystal growth, Exploration, Crystallography, Crystals, Size, Shape, Sampling, Laboratory tests, Frozen soils, Pingo ice, Crystal characteristics, Icing mounds.

Crystallization histories of some ice layers in permafrost were inferred from crystal size, shape, dimensional and lattice orientation, and inclusion patterns. In an icing mound, formed by injection of water beneath frozen active-layer soil, early growth was rapid, indicated by copious small crystals and bubbles, followed by slower growth giving rise to crystals and bubbles elongate parallel to the freezing direction. C-axes were normal to crystal long axes. In a small pingo, bulk water existed temporarily at the freezing interface and freezing was unidirectional. In a larger pingo, variations in freezing rate were inferred. Later flow of ice modifies growth fabrics. (Humphreys-ISWS)
W79-08116

ICE-WEDGE ICE, MACKENZIE DELTA-TUKTOYAKTUK PENINSULA AREA, N.W.T., CANADA,
Hardy (R. M.) and Associates, Calgary (Alberta).
W. A. Gell.
Journal of Glaciology, Vol. 20, No. 84, p 555-562, 1978. 5 fig, 14 ref.

Descriptors: *Ice, *Crystal growth, *Canada, *On-site investigations, Exploration, Crystals, Laboratory tests, Crystallography, Fabrics, Size, Shape, Petrography, Sampling, Ice wedges, Crystal characteristics.

Petrologic analysis was performed on ice-wedge ice in order to investigate changes in fabric across wedges in relation to the growth mechanism. Crystal size increased from the center outward, and strongly preferred dimensional orientations developed parallel to the sides of wedges. C-axis orientations changed from a horizontal girdle at wedge center to a point maximum normal to the folitation at the boundary. These changes are related to recrystallization and grain growth associated with the horizontal stress field. In massive ice penetrated by an ice wedge, crystal size and complexity of crystal shape decreased toward the wedge, dimensional orientations tended to become parallel to the wedge, and C-axes formed a point maximum normal to the wedge boundary. (Humphreys-ISWS)
W79-08117

FABRIC AND ORIGIN OF LATERAL MORAINES, BETHARTOLI GLACIER, GARHWAL HIMALAYA, INDIA,
Calgary Univ. (Alberta). Dept. of Geology.
G. D. Osborn.

Journal of Glaciology, Vol. 20, No. 84, p 547-553, 1978. 7 fig, 4 ref.

Descriptors: *Glacial drift, *Glaciology, *Exploration, *Geomorphology, Till, Glacial soils, Fabrics, On-site investigations, Foreign countries, *India, *Bethartoli Glacier, Till fabrics, Moraine fabric.

Unusually strong till fabrics in lateral moraines of Bethartoli Glacier provide information on the genesis and growth of the moraines. On the west side of the valley, downstream of the present glacier snout, several lateral moraine crests are justaposed. Because the crests generally become higher towards the valley axis, they must represent readvances of the glacier rather than recessional stages. On the east side of the valley, only a single lateral ridge is found; presumably the ridge is composed of debris from several glacial advances. On the eroded proximal flank of this ridge, a strong fabric is visible; the plane defined by a- and b-axes of stones is parallel to the distal flank of the moraine ridge, indicating that the moraine grew mainly by accretion of debris on to its distal flank. On the eroded proximal flank of the innermost west-side ridge, the equivalent fabric is weaker, suggesting that distal flank accretion was less significant and proximal flank accretion more significant than on the east side. (Humphreys-ISWS)
W79-08118

A DIRECT DETERMINATION OF AN UPPER LIMIT FOR THE ELECTRICAL CHARGE ON DISLOCATIONS IN ICE,
Illinois Univ. at Urbana-Champaign. Materials Research Lab.
D. M. Joncich, J. Holder, and A. V. Granato.
Journal of Glaciology, Vol. 20, No. 84, p 543-546, 1978. 2 fig. DMR-76-01058, DMR-77-10556.

Descriptors: *Ice, *Laboratory tests, *Electric fields, *Crystallography, Crystals, Methodology, Measurements, Zeta potential, Electrical properties, Ice dislocations, Electrical charge density.

A direct determination of the upper limit for the electric charge density along dislocations in ice was carried out by measuring the simultaneous effects of an electric field and a mechanical stress on the movement of a low-angle tilt boundary in an ice single crystal. The determination is independent of the geometry of the dislocations or the distribution of the charge along them. No measureable effects of the electric field on boundary motion were found, requiring that the charge density be less than one unit of charge for every 300 atomic lengths of dislocation. This estimate is less than large previous estimates, but it is consistent with smaller proposed values. (Humphreys-ISWS)
W79-08119

NUMERICAL MODELLING OF ICEBERG TOWING FOR WATER SUPPLIES--A CASE STUDY,
Adelaide Univ. (Australia). Dept. of Chemical Engineering.
J. G. Job.
Journal of Glaciology, Vol. 20, No. 84, p 533-542, 1978. 5 fig, 1 tab, 13 ref.

Descriptors: *Water supply, *Icebergs, *Model studies, *Transportation, *Antarctic, Melting, Mathematical models, Analytical techniques, Movement, Velocity, Energy, Ice, Analysis, Water yield, Iceberg towing, Acceleration.

The towing of unprotected icebergs from the Antarctic continent (66 deg S) to latitude 38 deg S has been simulated using an explicit hydrodynamic model and an extended two-dimensional melting model. It was found that nominal towing accelerations in excess of 0.00002 m/sec sq were required to deliver ice over this route in most circumstances, and minimum energy consumptions were obtained at accelerations around 0.0001 m/sec sq. Unprotected icebergs could be delivered with about 50% yield to latitude 38 deg S, but the rate of deterioration in the warm waters indicates that protection would be required for longer journeys. The towing simulation was most sensitive to north-south current components, the total towing distance, and the rate of iceberg deterioration. Efforts directed towards locating suitable icebergs in the region of 50 deg S to 60 deg S, and towards increasing knowledge of the changing current patterns in the Southern Ocean would be most valuable, as would a knowledge of the mechanisms and rates of deterioration of icebergs in warm seas. (Humphreys-ISWS)
W79-08120

A STUDY OF SEVERAL PRESSURE RIDGES AND ICE ISLANDS IN THE CANADIAN BEAUFORT SEA,
Gulf Oil Canada Ltd., Calgary (Alberta).
J. Hnatiuk, A. Kovacs, and M. Mellor.
Journal of Glaciology, Vol. 20, No. 84, p 519-532, 1978. 15 fig, 3 ref.

Descriptors: *Sea ice, *Exploration, *Canada, *On-site investigations, On-site tests, Methodology, Physical properties, Salinity, Density, Surveys, Water temperature, *Beaufort Sea(Canada), Pressure ridges, Ice islands.

The environmental conditions in the southern Beaufort Sea were described, with special emphasis on pressure ridges and ice islands. Techniques for determining the geometric configurations and the physical and mechanical properties of sea-ice structures and ice islands were described. Profile of pressure ridges were determined by surface surveys, drill-hole probes, and side-looking sonar scanning. Multi-year pressure ridges with thicknesses up to 20 m and widths up to 120 m were examined in detail. The first-year ridge of 22 m thickness and 100 m width was studied. Results were given for several multi-year and the first-year ridges. Information obtained from dives under the ice was also given. Corresponding data were given for grounded ice islands, with particular attention being given to contact between the ice and sea bed. A 20 m thick ice-island fragment grounded in 15 m of water was one of several investigated. Measurements of temperature, salinity, tensile strength, and compressive strength were given for ice taken from old pressure ridges, and factors influencing the interpretation of test data were discussed. The data obtained in this study will be used in engineering design studies for offshore structures for drilling and production of hydrocarbons from the Beaufort Sea area. Exploratory drilling in shallow water has already been carried out, and offshore drilling from drillships was scheduled to commence in the study area during the open water season of 1976. (Humphreys-ISWS)
W79-08121

THE EQUILIBRIUM STATE OF THE EASTERN HALF OF THE ROSS ICE SHELF,
Maine Univ. at Orono. Inst. for Quaternary Studies.
R. T. Thomas, and C. R. Bentley.
Journal of Glaciology, Vol. 20, No. 84, p 509-518, 1978. 4 fig, 1 tab, 19 ref. NSF DPP76-23047, OPP72-05802.

Descriptors: *Ice, *Antarctic, *On-site tests, *Exploration, On-site investigations, Physical properties, Velocity, Analysis, Analytical techniques, Mathematical models, Snow, Dimensions, *Ross Ice Shelf, Snow accumulation.

Measurements of ice thickness, velocity, snow accumulation rates, and surface strain-rates were used to examine the state of equilibrium of three flow bands of the Ross Ice Shelf. The analysis gave the rate of thickening of the ice shelf in terms of the basal freezing rate, which is unknown. However, indirect evidence suggests that the basal flux ranges from a small value of freezing in the south to a melting rate of about one meter of ice per year at the ice front. If these values are correct, then the flow band in the south-east corner of the ice shelf appears to be thickening at an average value of (34 + or -15) cm of ice per year. Persistent thickening at this rate must lead to grounding of large areas of the ice shelf. This would restrict drainage from West Antarctic ice streams which feed this part of the ice shelf and would tend to thicken and advance their grounding lines into the ice shelf. Further north, near the Ross Ice Shelf Project borehole site, the ice shelf is probably in equilibrium. The largest flow band is to the south and east of Roosevelt Island, and this also may be in equilibrium if there is significant bottom melting from ice shelf that is more than 100 km from the ice front. (Humphreys-ISWS)
W79-08122

BASAL SLIDING AND CONDITIONS AT THE GLACIER BED AS REVEALED BY BOREHOLE PHOTOGRAPHY,
California Inst. of Tech., Pasadena. Div. of Geological and Planetary Sciences.
H. F. Engelhardt, W. D. Harrison, and B. Kamb.
Journal of Glaciology, Vol. 20, No. 84, p 469-508, 1978. 10 fig, 3 tab, 43 ref.

Descriptors: *Glaciers, *Washington, *On-site investigations, *Subsurface investigations, Glaciology, Borehole geophysics, Photography, Movement, Velocity, flow, Exploration, Methodology, Boreholes, Analysis, Water levels, *Blue Glacier(WA), Basal flow.

Borehole photography demonstrates that the glacier bed was reached by cable-tool drilling in five boreholes in Blue Glacier, Washington. Basal sliding velocities, measured by borehole photography, and confirmed by inclinometry, range from 0.3 to 3.0 cm/d and average 1.0 cm/d, much less than half the surface velocity of 15 cm/d. Sliding directions deviate up to 30 deg from the surface flow direction. Marked lateral and time variations in sliding velocity occur. The glacier bed consists of bedrock overlain by about a 10 cm layer of active subsole drift, which intervenes between bedrock and ice sole and is actively involved in the sliding process. It forms a mechanically and visibly distinct layer, partially to completely ice-free, beneath the zone of debris-laden ice at the base of the glacier. Internal motions in the subsole drift include rolling of clasts caught between bedrock and moving ice. The largest sliding velocities occur in places where a basal gap, of width up to a few centimeters, intervenes between ice sole and subsole drift. The gap may result from ice-bed separation due to pressurization of the bed by borehole water. Water levels in boreholes reaching the bed drop to the bottom when good hydraulic connection is established with subglacial conduits; the water pressure in the conduits is essentially atmospheric. Factors responsible for the generally low sliding velocities are high bed roughness due to subsole drift, partial support of basal shear stress by rock friction, and minimal basal cavitation because of low water pressure in subglacial conduits. The observed basal conditions do not closely correspond to those assumed in existing theories of sliding. (Humphreys-ISWS)
W79-08139

LONG-RANGE FORECAST OF THE STRENGTH OF THE MELTING ICE COVER IN THE VOLGOGRAD RESERVOIR IN SPRING,
K. N. Polyakova.
Soviet Hydrology: Selected Papers, Vol. 16, No. 3, p 217-221, 1977. 3 fig, 4 tab, 8 ref. Translated from Trudy Gidrometsentra SSSR, No. 184, p 64-72, 1977.

Descriptors: *Reservoirs, *Ice cover, *Strength, *Forecasting, Ice, Lake ice, Navigation, Melting, Temperature, Solar radiation, Mathematical models, *Volgograd Reservoir(USSR), *Volga River.

A cascade of reservoirs has been constructed on the Volga River. Of these, the farthest downstream is the Volgograd Reservoir, which determines the beginning of navigation on the Volga. The forecasts of the clearance of the reservoir from ice, issued at the present time, do not satisfy the requirements of navigation, which frequently begins before ice starts to drift. Therefore, it had become necessary to forecast the strength characteristics of the melting ice cover. Our main purpose was to develop a method for the long-range forecasting of the strength characteristics of ice in spring under which icebreakers or ice-breaking vessels of a certain class can navigate at a given speed in ice. The

investigations showed that ice cover thickness changes insignificantly in the first days of melting. However, liquid inclusions and layers between crystals form at that time inside the ice, producing a sharp decrease in its strength. The dates of occurrence of a given ice cover strength were used as initial data in deriving the prognostic relations. These dates were determined for 26 years. (Sims-ISWS)
W79-08151

SHORT-RANGE FORECASTS OF RIVER BREAKUP ON THE BASIS OF A GENERAL MODEL OF THIS PROCESS,
S. N. Bulatov, and T. P. Silant'yeva.
Soviet Hydrology: Selected Papers, Vol. 16, No. 3, p 211-216, 1977. 2 fig, 2 tab, 3 ref. Translated from Transactions of the Hydrometeorological Scientific Center of the USSR (Trudy GMTs), No. 184, p 4-14, 1977.

Descriptors: *Ice breakup, *Rivers, *Model studies, *Forecasting, Mathematical models, Analytic techniques, Analysis, Methodology, Ice, Melting, Heat budget, Ice cover, Equations, *USSR.

The model of ice cover destruction makes it possible to develop methods for the short-range forecasting of the breakup of rivers in various physiographic regions of the USSR and with different breakup characteristics. This model was adopted for developing methods for the short-range forecasting of the breakup of all the rivers of the Soviet Union, since the principle for obtaining a prognostic relation is the same for any river. The relation for forecasting the breakup dates of the Syr-Dar'ya River at Karmakchey gave an error of + or - 2 days, with a probability of 86% for an average range of 5 days. The probability of the permissible error of + or - 2 days in forecasts from these relations varies from 85-95% for an average range of 5 days. The deviations of the computed from actual breakup dates are sometimes greater in individual years, possibly because of the unreliability of the initial data. Thus, the method based on the heat budget of the melting ice, applied to the largest rivers of Soviet Central Asia, gives positive results. (Humphreys-ISWS)
W79-08154

AN APPLICATION OF COSMIC-RAY NEUTRON MEASUREMENTS TO THE DETERMINATION OF THE SNOW-WATER EQUIVALENT,
Institute of Physical and Chemical Research, Tokyo (Japan). Cosmic Ray Lab.
M. Kodama, K. Nakai, S. Kawasaki, and M. Wada.
Journal of Hydrology, Vol. 41, No. 1/2, p 85-92, April 1979. 5 fig, 6 ref.

Descriptors: *Snow, *Measurement, *Instrumentation, *Equipment, Depth, Density, Moisture content, Snowpacks, Snow cover, Water resources, Snow-water equivalent, Cosmic-ray snow gages, Neutron meters.

Application of the water absorption character of cosmic-ray neutrons to the determination of the water equivalent depth of a snow cover was shown. This device was called the cosmic-ray snow gauge. The attenuation curves of the cosmic-ray snow gauge set under or in water or snow were experimentally obtained. Continuous field observations of the snow depths during 4 snow seasons demonstrated the effectiveness of the present device even for a snow cover of more than 1 m water equivalent, where the relative accuracy was found to be a few percent of the water depth. Possible effects of primary cosmic rays, barometric pressure, and water content of soil upon the determination of snow depths were discussed. (Sims-ISWS)
W79-08251

MODELING ICE REGIME OF LAKE ERIE,
Ecology and Environment, Inc., Buffalo, NY.
A. Wake, and R. R. Rumer, Jr.
Journal of the Hydraulics Division, American Society of Civil Engineers, Vol. 105, No. HY7, Proceedings Paper 14694, p 827-844, July 1979. 13 fig, 1 tab, 30 ref, 1 append. NOAA 03-6-022-35235.

Descriptors: *Lake ice, *Model studies, *Great Lakes, *Lake Erie, Mathematical models, Computer models, Heat flow, Heat exchangers, Heat transfer, Temperature, Air temperature, Ice, Lakes, Water temperature, Freezing, Dispersion, Currents(Water), Meteorological data.

A thermodynamic model for ice formation, growth and dissipation was developed to simulate the ice regime of Lake Erie. The model utilizes the two-dimensional convective dispersion equation for the heat balance of the body of water and the interfacial heat exchange equations to account for the various heat exchange processes at the air-water, air-ice, and ice-water interfaces. The hydrodynamic transport of heat by the lake currents was approximated by computing a steady-state current field using a vertically-integrated equation of motion. The climatological data recorded at Buffalo, New York, for the winter of 1975-76 were used in the heat exchange computations. Although the model has not been verified nor sufficiently calibrated, the general patterns of the two-dimensionally displayed computed results are in close agreement with the limited observations. (Sims-ISWS)
W79-08262

2D. Evaporation and Transpiration

PAN EVAPORATION IN ARID ZONE OF INDIA USING THE PENMAN EQUATION WITH MODIFIED AERODYNAMIC TERM,
Rookee Univ. (India). Dept. of Hydrology.
S. M. Seth.
Transactions of Indian Society of Desert Technology and University Centre of Desert Studies, Vol. 2, No. 2, p 208-211, Dec. 1977, 1 fig, 1 tab, 5 ref.

Descriptors: *Evaporation pans, *Evaporation, *Penman equation, Arid climates, Equations, Aerodynamic term, Energy equation, India.

Although the Penman method, which utilizes a combination of aerodynamic and energy balance equations, is the most widely used technique for computing evaporation, it has been shown to underestimate pan evaporation under arid conditions due to the low weightage given to the aerodynamic term. Accordingly, the present study examines the feasibility of using a modified aerodynamic term in the Penman equation for the arid zone of India. The results obtained using the data of Krishnan and Kushwaha indicate that this method is useful in accurately predicting pan evaporation. (Tickes-Arizona)
W79-08031

CALCULATION OF EVAPORATION DURING THE THREE STAGES OF SOIL DRYING,
Science and Education Administration, Phoenix, AZ. Water Conservation Lab.
S. B. Idso, R. J. Reginato, and R. D. Jackson.
Water Resources Research, Vol. 15, No. 2, p 487-488, April 1979. 1 fig, 6 ref.

Descriptors: *Evaporation, *Soil temperature, *Soil types, *Arizona, Soils, Climatic data, Climates, Solar radiation, Temperature, Air temperature, Equations, *Soil drying, *Daily evaporation rates, Incoming solar radiation, Reflected solar radiation, Avondale loam soil, Climatic conditions, Meteorological parameters.

A single equation was developed to calculate daily evaporation rates during all three stages of soil drying. The only required input data are daily incoming and reflected solar radiation and maximum and minimum air and soil surface temperatures. Experiments demonstrating the validity of the equation were conducted on an Avondale loam soil at Phoenix, Arizona, under a wide range of climatic conditions. It was shown that the effects of many important meteorological parameters are automatically accounted for by the direct measurement of the soil surface temperature. It remains to be seen if evaporation from other soils can be equally well described in this manner. (Roberts-ISWS)
W79-08138

A DIAGNOSTIC EXAMINATION OF A COMPLEMENTARY RELATIONSHIP BETWEEN ACTUAL AND POTENTIAL EVAPOTRANSPIRATION,
Waterloo Univ. (Ontario). Dept. of Geography.
E. F. LeDrew.
Journal of Applied Meteorology, Vol. 18, No. 4, p 495-501, April 1979. 1 fig, 3 tab, 20 ref.

Descriptors: *United States, *Canada, *Evapotranspiration, *Saturated soils, *Model studies, Saturated flow, Saturation, Water balance, Variability, Water loss, Climatic data, Watersheds(Basins), *Actual evapotranspiration, *Potential evapotranspiration, *Ireland, Five-year means, Experimental design, Variables, Radiant energy.

It was proposed by F. I. Morton in 1969 that the actual and potential evapotranspiration may behave in a complementary fashion about some definable constant as the regional surface dries from an initial saturated condition. This hypothesis was supported with an analysis of five-year means of water balance data for drainage basins in the United States, Canada, and Ireland. This paper examined the validity of the assumptions used in the derivation of this complementary relationship. The problem was approached by using a physically realistic diagnostic model of the energy fluxes within a closed system. The probable range of error attributable to eash assumption was evaluated from a data set derived from a series of model simulations. For the experimental design considered in the original hypothesis and replicated in the diagnostic model, it was concluded that specifying the sum of actual and potential evapotranspiration as a constant is physically unrealistic. The errors associated with this complementary relationship may be as large as the magnitude of the variable being estimated. (Roberts-ISWS)
W79-08245

DETERMINATION OF FOREST EVAPORTANSPIRATION USING BOWEN RATIO AND EDDY CORRELATION MEASUREMENTS,
British Columbia Univ., Vancouver. Dept. of Soil Science.
D. L. Spittlehouse, and T. A. Black.
Journal of Applied Meteorology, Vol. 18, No. 5, p 647-653, May 1979. 7 fig, 1 tab, 36 ref.

Descriptors: *Evapotranspiration, *Forests, *Measurement, Winds, Anemometers, Heat flow, Energy budget, Energy transfer, Evaporation, Moisture, Temperature, On-site investigations, Data processing, Regression anaysis, Correlation analysis, Analytical techniques.

Rates of evapotranspiration from a 14 m high Douglas fir forest on the southwest cost of British Columbia were obtained using the energy balance/Bowen ratio method and an energy balance/eddy correlation method. In the former method, the Bowen ratio was measured using reversing diode psychrometers. In the latter, the sensible heat flux was obtained by eddy correlation analysis of data obtained from a fast response thermistor and Gill anemometers mounted horizontally and at 30 deg from the vertical. The generally low wind speed above the forest resulted in occasional stalling of the anemometers and made obtaining adequate eddy correlation data difficult. Spectral analysis of the eddy correlation data indicates that a significant fraction of the sensible heat flux was at low frequencies. The regression relationship between evaportanspiration rate obtained using the energy balance/eddy correlation method (E sub e) and that obtained using the energy balance/Bowen ratio method (E sub Beta) was found to be E sub e = 0.96 sub Beta - 0.02 (mm/h). The experiment suggested that an eddy correlation system using mechanical anemometers is not suitable for extended water balance studies of forests where low wind speeds predominate. (Sims-ISWS)
W79-08248

REAL AND POTENTIAL EVAPOTRANSPIRATION UNDER DIFFERENT SALINE CONDITIONS,

A. M. Balba, and M. F. Soliman.
Alexandria Journal of Agricultural Research, Vol. 26, No. 1, p 247-254, 1978, 5 tab, 10 ref.

Descriptors: *Evaportanspiration, *Environmental effects, *Crop response, Irrigation effects, Saline soils, Saline waters, Sudangrass.

The purpose was to compare the results obtained from an equation developed by FAO to calculate the potential ET of several crops in Egypt with those equations developed b Penman, Blaney-Criddle, and Hargraves, and to test the results and applicability of all 4 equations ET values obtained experimentally under different salinity conditions. Sudan grass was grown in 21 soil drums using a sand culture irrigated with a nutrient solution containing 0, 15, and 30 meg/L of NaCl, NaSo4 or CaCl2. Solutions were applied with a sub-irrigation technique which allowed for the determination of the real ET under each treatment. Experimental results indicated that the effects of saline solutions in irrigation waters varies with both salt concentration and composition and results in restricted growth, particularly of the roots, decreased surface area of the leaves, increased leaf water content and decreased ET. Potential ET values calculated with the FAO, Hargraves, Blaney-Criddle, and Penman equations were found to be 84.7, 61.8, 52.9 and 49.2% of the real ET of plants under nonsaline conditions respectively. It is concluded therefore that all 4 equations are necessarily limited to ET determinations with nonsaline waters and soils. (Tickes-Arizona)
W79-08347

2E. Streamflow and Runoff

DYNAMICS OF FORMATION OF THE CHANNEL OF THE KARA-KUM CANAL,
For primary bibliographic entry see Field 2J.
W79-08099

URBANIZATION IMPACT ON STREAMFLOW,
Texas Univ. at Austin. Center for Research in Water Resources.
L. R. Beard, and S. Chang.
Journal of the Hydraulics Division, American Society of Civil Engineers, Vol. 105, No. HY6, Proceedings Paper 14623, p 647-659, June 1979. 3 fig, 5 tab, 4 ref, 1 append.

Descriptors: *Urbanization, *Texas, *Oklahoma, *Urban runoff, *Model studies, Mathematical models, Surface runoff, Permeability, Streamflow, Cities, Effects, Drainage, Rainfall, Precipitation(Atmospheric), Floods, Planning, Hydrology, *Tulsa(OK), *Oklahoma City(OK), *Dallas(TX), *Austin(TX), *Fort Worth(TX).

Studies of the impact of urbanization on runoff in the Tulsa metropolitan area were based on 114 floods recorded in Oklahoma City, Dallas, Fort Worth, and Austin, since satisfactory streamflow data were not available for Tulsa. It was found that impervious areas do not appreciably affect runoff timing, and they affect runoff volume much less than was anticipated. A model for computing urban runoff changes and calibration criteria were suggested, along with step-by-step procedure description. (Sims-ISWS)
W79-08107

GEOMETRY OF RIVERS IN REGIME,
San Diego State Univ., CA. Dept. of Civil Engineering.
H. H. Chang.
Journal of the Hydraulics Division, American Society of Civil Engineers, Vol. 105, No. HY6, Proceedings Paper 14640, p 691-706, June 1979. 9 fig, 24 ref, 2 append.

Descriptors: *Rivers, *Geomorphology, *Model studies, *Mathematical models, Braiding, Meanders, Channels, Canals, Roughness(Hydraulic), Regime, River beds, Sediments, Fluvial sediments, Sediment transport, Sediment load, Sedimentation, Flow, Flow resistance, Waterways.

An analytical method was developed for computing the self-adjusted geometry of sand-bed rivers based upon a sediment discharge formula, a flow resistance relationship, and the concept of minimum stream power. Regime rivers with low values of discharge Q and slope S are characterized by small width-depth ratios (generally less than 30) that are not sensitive to the change in slope or discharge. Most regime canals belong to this category. But for larger values of Q or S, or both, the results showed that regime rivers may have large, width-depth ratios sensitive to the changes in Q or S. As Q or S increases, the width-depth ratio of a regime river may become so large that it indicates a braided channel pattern. However, a much smaller width-depth ratio under this situation is also a possible stable geometry. The stable geometry was obtained from the stream power analysis wherein each stable configuration was assumed to correspond to a minimum stream power for the given constraints. (Sims-ISWS)
W79-08108

A NOTE ON THE POISSON ASSUMPTION IN PARTIAL DURATION SERIES MODELS,
Ireland Office of Public Works, Dublin.
C. Cunnane.
Water Resources Research, Vol. 15, No. 2, p 489-494, April 1979. 2 fig, 1 tab, 8 ref.

Descriptors: *Flood frequency, *Flood peak, *Model studies, *Mathematical models, Floods, Flow, Mathematics, Analytical techniques, Hydrology, *Poisson models, Poisson assumption.

The Poisson process is frequently encountered in probability models of the partial duration series. This paper looked at the necessity for specifying the model in detail by such a process and also examined the validity of the Poisson distribution, in the context, as judged on data from 26 gaging stations on 20 catchments in Great Britain. When all the data are considered jointly, the Poisson assumption has to be rejected, although it is acceptable in some cases. It was also suggested that if dependence exists in the partial duration series it should be looked for in the point process from which the series arises rather than among successive peak magnitudes. (Sims-ISWS)
W79-08109

TRIBUTARY DIAMETER IN TOPOLOGICALLY RANDOM CHANNEL NETWORKS,
Brock Univ., St. Catharines (Ontario). Dept. of Geological Sciences.
J-J. Flint, and J. R. Proctor.
Water Resources Research, Vol. 15, No. 2, p 484-486, April 1979. 3 tab, 9 ref.

Descriptors: *Tributaries, *Channels, *Networks, *Model studies, Mathematical models, Topography, Streams, Drainage, Watersheds(Basins), Hydrologic systems, Hydrology, Channel networks, Random channel networks, Tributary diameter.

The concept of channel diameter can be extended to define the number of links along the trunk channel of tributaries in a basin. In topologically random channel networks, the occurrence of tributaries with a specified diameter can be expressed by recursive equations for basins of given magnitude. Comparison with two sets of stream data indicated a close resemblance with calculated values. (Sims-ISWS)
W79-08110

PROCEEDINGS OF A SEMINAR ON NONSTRUCTURAL FLOOD PLAIN MANAGEMENT MEASURES,
Hydrologic Engineering Center, Davis, CA.
K. E. McIntyre, G. D. Cobb, F. H. Thomas, G. E. Dickey, and D. B. Duncan.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A052 607, Price codes: A10 in paper copy, A01 in microfiche. Seminar held at the Institute for Water Resources, Fort Belvoir, Virginia, May 4-6, 1976. Report HEC-SP-08, 1976. 193 p, 24 fig, 21 tab, 23 ref.

Descriptors: *Flood control, *Flood plains, *Flood protection, *Nonstructural alternatives, *Project planning, *Legal aspects, *Systems analysis, *Planning, *Flood plain management, Water management(Applied), Flood proofing, Flood damage, Flood plain acquisition, Water policy, Zoning, Land use, Water resources development, Administration, Economics, Benefit/cost analysis.

This report contains 16 papers pertaining to a variety of technical, institutional and political problems associated with implementation of nonstructural flood plain management measures. Nonstructural measures offer a wide range of opportunities to reduce flooding. Recommendations for achieving a unified national flood plain management program include greater Federal agency consistency in flood hazard evaluation; interagency cooperation in reviewing flood information requests; and the issuance of flood hazard guidelines once a year. Nonstructural flood control planning procedures include evaluation of benefits based on project outputs and institution of a cost sharing policy for environmental quality aspects of nonstructural measures programs. Better community dissemination of nonstructural flood measures, and Federal aid in flood plain land acquisition are suggested. Ongoing programs in the Northeast, South, and Pacific regions are discussed. The seminar highlighted the need for analytical tools to perform flood damage analysis; land use analysis for future development; social/institutional analysis, particularly of community financial capability; and development of a data management system in flood prone areas well suited to nonstructural flood measure planning. A final overview proposes the need for additional guidance in defining planning objectives and institutional roles consistent with national nonstructural flood measures objectives; further refinement/improvement of traditional benefit/cost analysis; and the need for an interdisciplinary approach in flood hazard management and analysis of local nonstructural flood protection needs. (Arnold-NC)
W79-08173

ENVIRONMENTAL PLANNING FOR THE METROPOLITAN AREA CEDAR-GREEN RIVER BASINS, WASHINGTON. PART II. URBAN DRAINAGE STUDY. APPENDIX C:STORM WATER MONITORING PROGRAM,
Army Engineer District, Seattle, WA. Seattle District.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A042 168, Price codes: A06 in paper copy, A01 in microfiche. Report, December 1974. 107 p, 5 append. 22 tab, 58 fig.

Descriptors: *Urban runoff, *Storm runoff, *Urban drainage, *Seattle(WA), *Green River Basin(WA), *Cedar River Basin(WA), *Environmental management, Washington, Overland flow, Storm water, Surface runoff, Storm drains, Effective precipitation, Unit hydrographs, Urbanization, Water pollution sources, Water pollution, Water quality, Waste water(Pollution), Washouts, Management.

This is part of an integrated study of water and waste management sponsored by the City of Seattle. The study was designed to provide a drainage management plan for use in development of an integrated environmental management plan for the Green and Cedar River Basins. This Appendix reports the results of a seven-month stormwater runoff study of the Seattle metropolitan area. Both quantity and quality of the runoff is assayed. Quantity was continuously measured by monitoring stormwater runoff and rainfall volume and intensity. Quality measurements were made for 29 parameters at specified intervals over six months. Rainfall runoff factors were low--ranging from 5% for low density residential areas to 64% for commercial areas--probably due to light rainfall intensity during the testing period. Pollutant washoff increased by land use, ranging from the lowest recordings for single family residential to new commercial to industrial to multiple residential to the highest recordings for old commercial areas. Major pollutants were solids, BOD, COD and oil. Nutrient and heavy metal loadings were low; coliform recordings in a sanitary sense were insignificant. Recommendations include extending the monitoring program, establishing a more complete

rain gauge network, sampling higher intensity storms, studying street pollutant buildups, improving calibration methods, using automatic sampling equipment and better analysis of the data. (Zayac-NC)
W79-08181

FLOOD PLAIN INFORMATION: MAHONING RIVER, TRUMBULL COUNTY, OHIO, NILES-MCDONALD-GIRARD-WEATHERSFIELD TOWNSHIP.
Army Engineer District, Pittsburgh, PA.
Prepared for the Mahoning-Trumbull Council of Governments, Trumbull County Planning Commission, and the Ohio Dept. of Natural Resources, June 1972. 30 p, 2 fig, 10 plates, 6 tab.

Descriptors: *Floods, *Regional flood, *Historic floods, *Flood data, *Ohio, *Mahoning River(OH), *Trumbull County(OH), Overflow, Indirect flood measurement, Maximum probable flood, Flood forecasting, Flood profiles, Storms, Flood stages, Peak discharge, Rivers, Floodways, Flood protection, Warning systems, Control structures, Dams, Mosquito Creek(OH), Meander Creek(OH), Intermediate regional flood, Niles(OH), Girard(OH).

This report presents flood plain information for the Mahoning River near the townships of Niles, McDonald, Girard, and Weathersfield in Trumbull County, Ohio. The drainage area of this part of the study area of the river is 888.2 square miles at the downstream limits. Averaging 20 miles in length, the entire watershed of the study reach is about 30.6 miles wide, and includes the tributaries of Meander Creek and Mosquito Creek. Development in the flood plain includes several railroad tracks subject to periodic flooding, three highways, and residential, industrial, and commercial development. Moderate expansion of development and facilities is projected and periodic flooding is predicted. The flood season extends from December to April, with most flooding resulting from heavy rain and snow melt. Data were obtained from U.S. Geological Survey and Corps of Engineers stream gages, newspaper files and historical documents and records. Major obstructions to flood flow include trees, brush, and other stream bank vegetation. The largest recorded flood occurred in March 1913, discharging 44,400 cubic feet per second (cfs) at the Youngstown gage, and reaching a height of 26.5 feet above flood stage. More recently serious flooding occurred in January 1959, with a discharge of 17,600 cfs at the Youngstown gage, reaching a height of 18.6 feet above flood stage. The Intermediate Regional Flood would discharge 21,000 cfs at the Youngstown gage. Flood control measures include three dams upstream of the study reach plus a fourth in Youngstown, downstream of the reach. No nonstructural flood measures beyond flood warning and forecasting and emergency evacuation plans have been established. (Arnold-NC)
W79-08187

FLOOD PLAIN INFORMATION: MAHONING RIVER AND CRAB CREEK, MAHONING COUNTY, OHIO, YOUNGSTOWN-CAMPBELL-STRUTHERS-LOWELLVILLE,
Army Engineer District, Pittsburgh, PA.
Prepared for the Mahoning-Trumbull Council of Governments and the Ohio Department of Natural Resources, June 1972. 36 p, 6 fig. 14 plates, 6 tab.

Descriptors: *Ohio, *Floods, *Regional flood, *Historic floods, *Flood data, *Flood protection, *Mahoning River(OH), *Mahoning County(OH), Indirect flood measurement, Maximum probable flood, Flood forecasting, Flood profiles, Storms, Flood stages, Peak discharge, Rivers, Floodways, Warning systems, Control structures, Dams, Reservoirs, Crab Creek(OH), Intermediate regional flood.

This report presents flood plain information for the Mahoning River and Crab Creek within Mahoning County, PA. It includes the communities of Youngstown, Campbell, Struthers and Lowellville. The drainage area of the downstream limit of the study reach is 1066.8 square miles. Heavy industrial development exists in the flood plain, especially around Youngstown. Six railroads and three highways parallel the banks of the Mahoning River. Flood information was obtained from stream gaging stations operated by the U.S. Geological Survey, from newspaper files, historical documents and records. The flood season extends from December to April, with most flooding resulting from heavy rain and snow melt. Three multi-purpose dams in the basin upstream of the report reach reduce major floods in the area by an average of 3 to 6 feet. Duration of flooding is short on Crab Creek, usually less than 24 hours, but on the Mahoning River it may approach three days in length. The largest flood in the area's history occurred in March 1913, discharging 44,400 cubic feet per second (cfs) at the Youngstown gage, and reaching a height of 26.5 feet above flood stage. More recently, the January 1959 flood discharged 17,600 cfs, rising to 18.6 feet above flood stage. The Intermediate Regional Flood (IRF) would discharge 21,000 cfs at the Youngstown gage. This report is intended as a basis for adoption of land use controls to guide flood plain development. (Arnold-NC)
W79-08188

FLOOD PLAIN INFORMATION: MAHONING RIVER, TRUMBULL COUNTY, OHIO, CITY OF WARREN-LEAVITTSBURG, WARREN AND HOWLAND TOWNSHIPS,
Army Engineer District, Pittsburgh, PA.
Prepared for the Mahoning-Trumbull Council of Governments, Trumboff County Planning Commission, and the Ohio Dept. of Natural Resoucres. June 1972. 28 p, 2 fig, 10 plates, 6 tab.

Descriptors: *Ohio, Floods, *Regional flood, *Historic floods, *Flood data, *Mahoning River(OH), *Trumbull County(OH), Overflow, Indirect flood measurement, Maximum probable flood, Flood forecasting, Flood profiles, Storms, Flood stages, Peak discharge, Rivers, Floodways, Flood protection, Warning systems, Control structures, Dams, Intermediate regional flood, Howland(OH), Warren(OH).

This report presents flood plain information for the Mahoning River within Warren and Howland Townships in Trumbull County Ohio. The drainage area of the downstream limit of the study reach is 612.8 square miles. Averaging 20 miles in length, this study section of the watershed is about 30.6 miles wide, and includes the tributaries of West Branch-Mahoning River, Eagle Creek, Duck Creek, Meander Creek, and Mosquito Creek. Development in the flood plain is urban residential, commercial, and industrial. The study reach is flanked by five roads and a stretch of railroad. Three city parks border this stretch of the river. The flood season extends from December to April, with most flooding resulting from heavy rain and snow melt. Major obstructions to flood flow include trees, brush, and other streambank vegetation. Data were obtained from U.S. Geological Survey and Crops of Engineers gaging stations, newspaper files, and historical documents and records. The largest recorded flood occurred in March 1913, discharging 33,700 cubic feet per second (cfs) at the Warren gage, and reaching a height of 21.1 feet above flood stage. More recently, serious flooding occurred in January 1959, with a discharge of 16,000 cfs, rising to 16.7 feet above flood stage. By contrast, the Intermediate Regional Flood (IRF) for the study reach would discharge 16,8000 cfs. Velocities of flow would vary from 3 feet per second overbank flow to main channel speeds of 9 feet per second. Flood control measures include two dams upstream of the study reach. No nonstructural measure beyond flood warning and forecasting and emergency evacuation plans have been established. (Arnold-NC)
W79-08189

SPECIAL FLOOD HAZARD INFORMATION REPORT: WALNUT CREEK, MANSFIELD, TEXAS,
Army District, Fort Worth, TX.
Prepared for the City of Mansfield, Texas July 1973. 16 p, 2 fig, 5 plates, 2 tab.

Descriptors: *Texas, *Floods, *Flood protection, *Walnut Creek(TX), *Mansfield(TX), *Flood plain management, Flooding, Historic floods, Flood frequency, Flood stages, Peak discharge, Rivers, Floodways, Flood plains, Standard project flood, Flood plain zoning, Warning systems, Building codes, Land use, Planning, Zoning, Control structures, Floodproofing, Intermediate regional flood.

This report details flood information for the Walnut Creek watershed near Mansfield, Texas, about 10 miles southeast of Fort Worth. A drainage area of about 85.6 square miles. the basin experienced serious flooding in the spring seasons of 1969 and 1973. There are no official gaging stations in the area. Peak discharge on Walnut Creek below Hogpen Branch was 24,000 cubic feet per second (cfs). The 100-year (Intermediate Regional) Flood would increase water depth up to 22 feet in excess of normal streambed depth. Concern exists for the City of Mansfield, which grew in population by 37% between 1970 and 1973, with some housing construction and economic development encroaching on the floodplain. Although no flood control structures existed on the creek at the time of the report, Corps of Engineers construction of the Lakewiew Dam on nearby Mountain Creek might affect Walnut Creek. Guidelines for floodplain management are presented, including selective zoning with designation of encroachment lines delineating the floodway zone, narrowing the floodway to accommodate controlled economic development in the adjacent floodplain, institution of new subdivision regulations, floodproofing existing structures, establishing regulations to control sewage disposal in the floodway, developing faster and more accurate flood forecasting, and creating development policies which would control extension of public services into the flood hazard area. The purpose of the report is to define the flood risk involved in development of the area studied. (Arnold-NC)
W79-08190

SPECIAL FLOOD HAZARD INFORMATION REPORT: WHITE OAK CREEK, DIBOLL, TEXAS.
Army Engineer District, Fort Worth, TX.
Prepared for the City of Diboll, Texas July 1973. 14 p, 1 fig, 2 plates, 2 tab.

Descriptors: *Texas, *Floods, *Flood protection, *Diboll(TX), *White Oak Creek(TX), Flooding, Flood profiles, Historic floods, Flood data, Flood stages, Peak discharge, Flood peak, Rivers, Flood plains, Flood plain zoning, Flood plain insurance, Building codes, Land use, Planning, Zoning, Control structures, Floodproofing, Intermediate regional flood, Neches River(TX), Angelina County(TX), Flood plain management.

This report gives flood information for the portion of the White Oak Creek watershed from just north of the city of Diboll, 5.5 miles southwest to its confluence with the Neches River near the U.S. Highway 59 crossing. The basin lies about 150 miles southeast of the Dallas metropolitan area. A drainage area of about 7.6 square miles, White Oak Creek is prone to occasional flooding. The watershed averages about 1.4 miles in width. No major developments exist in the watershed. No gaging information is available for the creek, but based upon records of nearby streams, estimated peak flow is 7,700 cubic feet per second (cfs) for the Intermediate Regional Flood (IRF) at State Highway 59. Major causes of flooding are from frontal-type storms in the spring, although intense thunderstorms may occur at any time during the year. The IRF is calculated to top three of the five bridges in the study area. No flood control or structural measures were in effect at the time of this report. The study presents guidelines for floodplain management, including nonstructural measures such as selective zoning for the floodway and the adjacent flood plain; subdivision regulations and building codes for the flood plain; better control over sewage waste disposal; more accurate and timely flood forecasting; and development policies controlling the extension of public services into the flood hazard areas of the White Oak Creek Basin. (Arnold-NC)

W79-08191

FLOOD HAZARD ANALYSES, CARIBOU STREAM, CITY OF CARIBOU, AROOSTOOK COUNTY, MAINE,
Soil Conservation Service, Orono, ME.
Report, September 1977, 10 p, 11 plates, 3 tab, 8 ref.

Descriptors: *Maine, *Flood profiles, *Rivers, *Control structures, *Dams, *Caribou Stream(ME), *Caribou(ME), *Aroostook County(ME), Floods, Indirect flood measurement, Storms, Hurricanes, Historic floods, Flood data, Flood stages, Peak discharge, Flood plains, Flood protection, Flood plain insurance, Farnham Brook(ME), Mile Brook(ME), 100-year flood, 500-year flood.

This report details flood hazard areas along 3.2 miles of the Caribou Stream and its tributaries: 0.4 mile of Farnham Brook and 1.4 miles of Mile Brook in the vicinity of the City of Caribou. Caribou is located in northeastern Aroostook County in the northeastern section of Maine. The Caribou Stream Watershed has a drainage area of about 50 square miles from its headwaters east to its confluence with the Aroostook River at Caribou. Average flood plain width is approximately 500 feet. The portion of the study reach along the Caribou Stream has an average slope gradient of about 0.004 ft/ft or 21.1 ft/mile. Development in the flood plain includes residential, agricultural, and commercial uses. Caribou is experiencing increasing urbanization and development pressures will continue to increase. Flood history was obtained from newspaper records. No gage information is available. Flooding is due primarily to spring rains and snowmelt runoff. Major floods occurred in May 1923, September 1954 (from Hurricane effects), and in April 1973. The 1954 flood, bringing six inches of rainfall, was equivalent to the 100-year flood and 6-7 feet for the 500-year flood. The report recommends establishment of a flood plain management program. The study area participates in the National Flood Insurance Program. (Arnold-NC)
W79-08192

FLOOD HAZARD ANALYSES: LITTLE OSSIPEE RIVER, TOWN OF LIMINGTON, MAINE - YORK COUNTY.
Soil Conservation Service, Orono, ME.
Report, September 1977, 6 p, 14 plates, 2 tab, 8 ref.

Descriptors: *Maine, *Flood profiles, *Rivers, *Dams, *Little Ossipee River(ME), *Limington(ME), *York County(ME), *Control structures, Floods, Regional flood, Indirect flood measurement, Historic floods, Flood data, Flood stages, Peak discharge, Flood plains, Flood protection, Flood plain insurance, Zoning, 100-year flood, 500-year flood, Saco River(ME).

This report details flood hazard areas along an 11-mile stretch of the Little Ossipee River in the vicinity of Limington in York County, Maine. The Little Ossipee River watershed has a drainage area of about 185 square miles near its confluence with the Saco River in East Limington. Major land uses in the flood plain are woodland and water-based recreation areas. There are no urban centers located adjacent to the flood plain, but significant development pressure exists for construction of permanent and seasonal homes within the flood plain area. A U.S. Geological Survey gage is located on the Little Ossipee River near South Limington. The highest recorded discharge at the gage occurred in May 1954, measuring 5,300 cubic feet per second (cfs). Flooding occurs almost annually and is caused primarily by spring snowmelt runoff and summer rainfall. The flood of record occurred in March 1936, discharging 8,530 cfs just upstream of the study area. This discharge slightly exceeded the predicted 100-year flood. No records of significant flood damage exist. Estimated peak discharges for the 100-year and 500-year floods are 7,760 cfs and 11,800 cfs at the U.S. Geological Survey gaging station. Maximum height above flood stage would be about 4-5 feet for the 100-year flood and 6-7 feet for the 500-year flood. Flood control measures include dams and spillways at five locations and participation in the National Flood Insurance Program. The report is intended to provide a technical basis for instituting flood plain management programs. (Arnold-NC)
W79-08193

FLOOD HAZARD ANALYSES: GREAT WORKS RIVER, TOWN OF SOUTH BERWICK, MAINE, YORK COUNTY,
Soil Conservation Service, Orono, ME.
September 1977, 6 p, 17 plates, 2 tab, 9 ref.

Descriptors: *Maine, *Flood profiles, *Rivers, *Control structures, *Dams, *South Berwick(ME), *Great Works River(ME), *York County(ME), Floods, Regional flood, Historic floods, Indirect flood measurement, Flood data, Flood stages, Peak discharge, Flood plains, Flood protection, Flood plain zoning, Flood plain insurance, Zoning, Boyd Brook(ME), Chicks Brook(ME), White Marsh Brook(ME), 100-year flood, 500-year flood.

This report details flood hazard information for that 13-mile portion of the Great Works River from the Town of South Berwick, Maine, south to its confluence with the Salmon Falls River on the New Hampshire border, and includes the tributaties of Boyd Brook, Chicks Brook, and White Marsh Brook. The drainage area of the Great Works River is 86 square miles within York County, Maine. Average flood plain width is defined as 500 feet. Major land uses in the flood plain are woodland and agriculture. Three dams are located in the study area; there are also 10 bridges and one pipeline. Due to the study reach's proximity to the Town of South Berwick, increasing urbanization and development in the flood plain are likely to occur. No gage data are available. Flooding is caused primarily by spring snowmelt runoff and summer rainfall. The flood of March 1936 is considered the largest in recent years; a flow discharge equivalent to the 100-year flood occurred. No records of significant flood damage exist for this area. Estimated peak discharges for the 100-year and 500-year floods are 8,101 cubic feet per second (cfs) and 11,000 cfs, respectively. Maximum height above flood stage would be an average of 4-5 feet for the 100-year flood and 6-7 feet for the 500-year flood. The 500-year flood would overtop three bridges and one road in the area. Three dams help control flood flows; South Berwick participates in the National Flood Insurance Program. This report is intended to provide a technical basis for developing a flood plain management program. (Arnold-NC)
W79-08194

FLOOD HAZARD ANALYSES: GREAT WORKS RIVER, TOWNS OF NORTH BERWICK AND SANFORD, MAINE - YORK COUNTY,
Soil Conservation Service, Orono, ME.
Report, September 1977, 6 p, 20 plates, 2 tab, 9 ref.

Descriptors: *Maine, *Flood profiles, *Rivers, *Control structures, *Dams, *North Berwick(ME), *Sanford(ME), *Great Works River(ME), *York County(ME), Floods, Regional flood, Indirect flood measurement, Historic floods, Flood data, Flood stages, Peak discharge, Flood plains, Flood protection, Flood plain zoning, Flood plain insurance, Zoning, Goodall Brook(ME), 100-year flood, 500-year flood.

This report identifies and details flood hazard areas along a 14-mile stretch of the Great Works River and 1 mile of Goodall Brook in the vicinity of the towns of North Berwick and Sanford, York County, Maine. The Great Works River watershed has a drainage area of 86 square miles. Average flood plain width is defined as about 500 feet. Land use in the flood plain consists mostly of woodland and agriculture; twelve highway bridges, one railroad bridge, and three dams are located within the study reach. Increasing urbanization and resulting pressure on the flood plain are predicted from future growth of the towns of Sanford and North Berwick. No gage data are available. Flooding is caused primarily by spring snowmelt runoff and summer rainfall. The largest flood is considered to be the flood of March 1936, when a flow discharge equivalent to the 100-year flood occurred. No records of significant flood damage exist for this area. Estimated peak discharges for the 100-year and 500-year floods are a maximum of 3,640 cubic feet per second (cfs) and 5,180 cfs, respectively. Maximum height above flood stage would be an average of 4-5 feet for the 100-year flood and 6-7 feet for the 500-year flood on the study reach. The 500-year flood would overtop five bridges in the area. Flood control measures include three dams; the towns of Sanford and North Berwick participate in the National Flood Insurance Program. This report is intended to provide a technical basis for developing a flood plain management program. (Arnold-NC)
W79-08195

ON THE EFFECT OF PRECIPITATION AND RUNOFF ON COASTAL CIRCULATION IN THE GULF OF ALASKA,
Alaska Univ., Fairbanks. Inst. of Marine Science.
For primary bibliographic entry see Field 2L.
W79-08237

ZONALITY OF GROUND-WATER RUNOFF UNDER HUMID CONDITIONS,
For primary bibliographic entry see Field 2F.
W79-08284

ANALYSIS OF UNCERTAINTY IN FLOOD PLAIN MAPPING,
Washington Univ., Seattle. Dept. of Civil Engineering.
S. J. Burges.
Water Resources Bulletin, Vol. 15, No. 1, p 227-243, February 1979. 2 fig, 2 tab, 23 ref, 2 append.
OWRT A-097-WASH(1).

Descriptors: *Flood plains, *Mapping, *Risks, *Urbanization, *Planning, Statistical methods, Flood plain zoning, Flood frequency, Non-structural alternatives, Methodology, Decision making, *Flood plain mapping, First order uncertainty analysis, Flood plain geometry, Flood frequency distributions.

Components contributing to uncertainty in the location of the floodplain fringe of a mapped floodplain were identified and examined to determine their relative importance. First-order uncertainty analysis was used to provide a procedure for quantifying the magnitude of uncertainty in the location of the floodplain fringe. Application of the procedure indicated that one standard deviation of uncertainty in floodplain inundation width was about 1/3 of the mean computed inundation width for several floodplain geometry combinations. Suggested mapping criteria, which directly incorporate uncertainty estimates, were given. While these criteria are more suitable for use in developing areas than in floodplains that have had extensive development, the analysis procedure can be used to accommodate property owners who challenge the validity of estimated flood fringe boundaries. Use of uncertainty analysis in floodplain mapping should enhance the credibility of the final plan. (Singh-ISWS)
W79-08340

LOW-FLOW CHARACTERISTICS OF SMALL STREAMS IN PROPOSED PUBLIC LAW 566 BASINS,
Geological Survey, Madison, WI. Water Resources Div.
S. J. Field.
Geological Survey open-file report 78-664, October 1978. 32 p, 2 fig, 16 tab, 7 ref.

Descriptors: *Low flow, *Streamflow forecasting, *Low-flow frequency, *Regression analysis, *Wisconsin, Small watersheds, Gaging stations, Base flow, Evaluation.

Low-flow characteristics of small streams at 278 sites in 32 basins in Wisconsin which are being considered for work under Public Law 566 are presented. The low-flow characteristics are the annual minimum 7-day mean flow below which the flow will fall on the average of once in 10 years

and the annual minimum 7-day mean flow below which the flow will fall on the average of once in 2 years. The low-flow characteristics at these sites were determined by correlating base-flow measurements at the ungaged sites to the concurrent daily mean flow at continuous-record gaging stations in the area. The statewide average of the accuracy determined by the standard error of estimate for the 10-year low flow, based on three base-flow measurements, is 45 percent but differs within the State. (Woodard-USGS)
W79-08388

SELECTED STREAMFLOW DATA FOR THE DELAWARE RIVER BASIN,
Geological Survey, Trenton, NJ. Water Resources Div.
R. D. Schopp, and B. D. Gillespie.
Geological Survey open-file report 79-347, February 1979. 16 p, 8 fig, 3 tab, 7 ref.

Descriptors: *Hydrologic data, *Delaware River, *Streamflow, Rainfall-runoff relationships, *Low flow, Natural flow, Gaging stations, Duration curves, Hydrographs, Isohyets, Frequency analysis, Correlation analysis, Damsites, Tributaries, Pennsylvania, New Jersey, New York.

Selected streamflow data for the Delaware River basin include runoff-precipitation relationships for 28 selected subbasins for the period 1941-70; low-flow frequency curves for four mainstem Delaware River sites; monthly comparative duration curves and twenty year hydrographs at Montague and Trenton, New Jersey; and flow duration tables based on observed daily streamflow for gaging stations near 21 proposed dam sites. (Woodard-USGS)
W79-08389

MAGNITUDE AND FREQUENCY OF FLOODS FOR SMALL WATERSHEDS IN LOUISIANA,
Geological Survey, Baton Rouge, LA. Water Resources Div.
For primary bibliographic entry see Field 6A.
W79-08397

ANNUAL PEAK DISCHARGES FROM SMALL DRAINAGE AREAS IN MONTANA FOR STATIONS DISCONTINUED BEFORE 1978,
Geological Survey, Helena, MT. Water Resources Div.
R. J. Omang, J. A. Hull, and C. Parrett.
Geological Survey open-file report 79-510, May 1979. 117 p, 2 fig.

Descriptors: *Peak discharge, *Floods, *Crest-stage gages, *Small watersheds, *Montana, Surface runoff, Streamflow, Flood peak, Basic data collections.

Annual peak stage and discharge data have been tabulated for crest-stage gage sites in Montana. The crest-stage program was begun in July 1955 to investigate the magnitude and frequency of floods from samll drainage areas. The program has expanded from 45 crest-stage gaging stations initially to 172 stations maintained in 1978. From 1955 to 1978, 156 stations have been discontinued. This report is a tabulation of the stage and discharge data for the discontinued stations. (Woodard-USGS)
W79-08398

STRATEGIES FOR RESERVING FLOWS FOR FISH AND WILDLIFE: IDENTIFICATION, DESCRIPTION, AND PRELIMINARY EVALUATION,
Dewsnup (Richard L.)/Dallin W. Jensen, Salt Lake City, UT.
For primary bibliographic entry see Field 6E.
W79-08401

WILLAMETTE BASIN COMPREHENSIVE STUDY OF WATER AND RELATED LAND RESOURCES: APPENDIX E--FLOOD CONTROL.
Pacific Northwest River Basins Commission, Portland, OR. Willamette Basin Task Force.
For primary bibliographic entry see Field 6F.
W79-08438

FLOOD PLAIN INFORMATION: SHREVEPORT, LOUISIANA, NO. 3, LOGAN AND CHOCTAW BAYOUS,
Army Engineer District, New Orleans, LA.
Prepared For City of Shreveport, LA, April 1974, 33 p, 15 fig, 19 plates, 6 tab.

Descriptors: *Floods, Historic floods, *Flood data, *Flood stages, *Peak discharge, *Shreveport(LA), *Logan Bayou(LA), Flooding, Flood flow, Indirect flood measurement, Flood profiles, Flood frequency, Flow duration, Stage-discharge reglations, Rivers, Flood plains, Standard project flood, Warning systems, Intermediate regional flood, *Louisiana.

This report gives flood information on the Logan and Choctaw Bayous northwest of Shreveport, Louisiana. The Logan Bayou has a drainage area of 19.6 square miles with an average streambed slope of 11.6 feet per mile, while the drainage of the Choctqw Bayou is 14.8 square miles with a slope gradient of 7.5 feet per mile. Flood plain sidth varies from about 300-700 feet. There is little development other than grazing andfarming in the flood plain, although future urban expansion is predicted. Floods due to heavy rains can occur in any season. Data were obtained from stream gages, newspaper files, higtorical documents and records. There are no flood damage reduction measures in the study area. Large floods have occurred in the area but little specific data are available. The Intermediate Regional Flood (IRF) would discharge 7,600 cubic feet per second (cfs) on Logan Bayou, and 6,800 cfs on Choctaw Bayou, while the Standard Project Flood (SPF) would discharge 13,900 cfs and 11,800 cfs on Logan and Choctaw Bayous, respectively. Maximum rates of rise for the IRF are 1.9 ft/hr on Logan Bayou and 2.2 ft/hr on Choctaw Bayou, and for the SPF, 1.1 ft/hr and .05 ft/hr for Logan and Choctaw Bayous, respectively. Obstructions to floodlow include vegetation, dams and bridges. A major flood occurred in the area in November 1969 after a 7-inch rainfall. This report is intended as an aid in land use planning and management decisions concerning flood plain utilization. (Arnold-NC)
W79-08446

FLOOD PLAIN INFORMATION: CUYAHOGA RIVER, MANTUA AND HIRAM, PORTAGE COUNTY, OHIO,
Army Engineer District, Buffalo, NY.
Prepared for Ohio Department of Natural Resources - Water Division, and Tri-County Regional Planning Commission, April 1972, 47 p, 8 fig, 10 plates, 8 tab.

Descriptors: *Ohio, *Floods, *Historic floods, *Flood stages, *Flood data, *Peak discharge, *Cuyahoga River(OH), *Mantua(OH), *Hiram(OH), *Portage County(OH), Flooding, Flood flow, Indirect flood measurement, Flood forecasting, Flood profiles, Flow duration, Stage-discharge relations, Rivers, River beds, Floodways, Flood plains, Channels, Standard Project Flood, Flood protection, Control structures, Reservoirs, Intermediate Regional Flood.

This report covers a 7.6 mile area of the Cuyahoga River including the village of Mantua and Hiram Townships in Northeastern Ohio. Little development had taken place at the time of the report, although future growth of the nearby city of Akron would exert pressure for expansion into the floodplain. Data were obtained from a U.S. Geological Survey gage at Hiram Rapids, interviews, newspaper files and historical records. Flooding is caused by spring snowmelt and intense summer and fall thunderstorms. Obstructions to floodflow include inadequate bridge areas, and abandoned dams and natural obstructions. The largest recorded flood occurred in January 1959, discharging 3,800 cubic feet per second (cfs) and cresting at 8.1 feet above flood stage. The Intermediate Regional Flood (IRF) would discharge 5,100 cfs and crest at 9.3 feet, while the Standard Project Flood (SPF) would discharge 18,300 cfs and crest at 18 feet. At the time of the report, no flood plain management program existed for the area, although one is recommended. Two reservoirs on the study reach regulate river flow. (Arnold-NC)
W79-08447

FLOOD PLAIN INFORMATION: MISSISSIPPI RIVER AND RIPPLE RIVER, AITKIN, MINNESOTA,
Army Engineer District, St. Paul, MN.
Prepared for The City of Aitkin, Minnesota, June 1975, 33 p, 23 fig, 22 plates, 4 tab.

Descriptors: *Minnesota, *Floods, *Indirect flood measurement, *Flood profiles, *Historic floods, *Flood stages, *Peak discharge, *Aitkin(MN), *Mississippi River(MN), *Ripple River(MN), Runoff, Flood flow, Flood forecasting, Flood data, Flood frequency, Stage-discharge relations, Rivers, River beds, Floodways, Standard project flood, Flood protection, Warning systems, Control structures, Levees, Reservoirs, Diversion structures, Channel improvement, Intermediate regional flood.

The study area covered by this report is the portion of Aitkin subject to flooding from the Mississippi and Ripple Rivers in central Minnesota. The study reach includes a 14.8 mile length of the Mississippi and a 5.8 mile length of the Ripple River. Development in the flood plain includes small industry, residential, some recreation facilities and the city sewage treatment plant. A gage is located on the Mississippi at the town of Atikin. Major cuases of flooding are runoff from spring snowmelt and occasional prolonged periods of summer rainfall. Obstructions to the flood flow include dams and bridges. Flood protection measures include a channel diversion project on the Mississippi, limited protection from four federal reservoirs, earth levees, and flood warning and forecasting. The 1975 flood had a peak of 7,800 cubic feet per second, and crested 18.0 feet above flood stage. The greatest recorded flood occurred in May 1950, with a peak discharge of 20,000 cfs, equivalent to that of the Standard Project Flood (SPF). The Intermediate Regional Flood (IRF) would discharge 10,700 cfs and crest 21.6 feet above flood stage. The SPF would crest at 25.0 feet, in contrast to the 1950 flood, which crested at 22.5 feet. This report furnishes a suitable basis for adoption of land use controls to guide flood plain development. (Arnold-NC)
W79-08448

SOME MIDSUMMER DIATOM ASSEMBLAGES ALONG THE SALINE GRADIENT OF A SMALL COASTAL STREAM IN KACHEMAK BAY, ALASKA,
Rutgers - The State Univ., Newark, NJ. Dept. of Botany.
For primary bibliographic entry see Field 2I.
W79-08494

2F. Groundwater

COST OF WELL WATER IN COIMBATORE REGION,
Tamil Nadu Agricultural Univ., Coimbatore (India).
R. K. Sivanappan, and P. K. Aiyasamy.
Irrigation and Power, Vol. 35, No. 4, p 509-514, Oct. 1978. 5 tab, 1 fig, 6 ref.

Descriptors: *Wells, *Groundwater, *Well data, *Pumping, *Alternative planning, *Regional development, *Regional analysis, *Economic feasibility, *Cost analysis, Well regulations, Water conservation, Irrigation engineering, Water resources development, Overdraft, India, Planning, Drawdown.

Wells can appropriately be called the heart of life in the Coimbatore region of India where the number of wells, already amounting to more than 1,500,000 in 1971 is rapidly increasing with a growing dependence upon groundwater resources. Often indiscriminately placed and poorly designed, these wells are seriously jeopardizing the future of

these same resources and necessitating an evaluation of the overall situation and the cost under these circumstances of irrigation. An attempt is made here to provide such an analysis based upon a few selected case studies with the purpose of formulating policy measures to ensure short run benefits and safeguard long term conservation efforts. Information concerning well dimension, year of construction, investments made, irrigation potentials and area covered over seasons were collected through farmer interviews for 10 selected wells in existence for 3 decades within a radius of 15 km of Coimbatore. Results indicated that (1) well depth has consistently increased during periods of low rainfall, (2) well size at ground level has been decreased to prevent caving and reduce investment cost, (3) average discharge ranged from 20,000 to 67,500 liters per hour with the lower flows occuring during the summer months, and (4) supplemental engines were added to sustain lifting power. Although hampered by the extreme variability of several factors and a lack of quality data, a complete economic analysis including overhead costs, investment outlays, charges on depreciation of pumping machinery and equipments, charges paid for electric consumption and annual maintenance and repair charges is presented. Policy suggestions based upon the accumulated information are reviewed. (Tickes-Arizona)
W79-08024

GROUND WATER RESOURCES IN SEMI ARID AREA OF COIMBATORE DISTRICT, TAMIL NADU,
Afpro Git, Varanasi (India).
P. Loganathan.
Transactions of Indian Society of Desert Technology and University Centre of Desert Studies, Vol. 2, No. 2, p 182-184, Dec 1977. 2 fig, 1 tab, 2 ref.

Descriptors: *Well data, *Groundwater resources, *Water resources development, *Hydrogeology, Water wells, Water utilization, Groundwater recharge, Water conservation, Bore holes, Dug wells, Water management(Applied), Water table.

Results of geohydrological investigations conducted in the semi-arid areas of Coimbatore District, Tamil Nadu, India during 1974-75 to determine groundwater conditions are reported. Analysis of more than 150 bore wells classified according to yield indicate that more than 70% of the groundwater yield is tapped within 50 meters of the surface and it is accordingly uneconomical to drill deeper than this depth. In addition to the bore wells, a large number of dugwells and dug-cum wells which are utilized in this area during low rainfall years are being deepened every year by 1 to 2 meters, lowering the water table to 20-30 meters below ground level. Based upon these results it is suggested that a program should be developed to: (1) artificially recharge groundwater reserves, (2) develop the existing dug wells with horizontal bores, (3) practice effective conservation and management methods, and (4) rock shoot to develop artificial fractures and fissures. (Tickes-Arizona)
W79-08029

TRANSIENT RESERVOIR-AQUIFER INTERACTION,
Northeastern Univ., Boston, MA. Dept. of Civil Engineering.
For primary bibliographic entry see Field 2H.
W79-08100

STORAGE COEFFICIENTS FROM AQUIFER MAPS,
Govind Ballabh Pant Univ. of Agriculture and Technology, Pantnagar (India). Dept. of Civil Engineering.
B. M. Sahni, and H. S. Seth.
Journal of the Irrigation and Drainage Division, American Society of Civil Engineers, Vol. 105, No. IR2, Proceedings Paper 14658, p 205-212, June 1979. 4 fig, 6 ref, 2 append.

Descriptors: *Aquifer characteristics, *Storage coefficient, *Groundwater, Observation wells, Potentiometric level, Maps, Water levels, Artesian heads, Aquifer testing, Wells, Hydrology, Groundwater resources, Foreign countries, Foreign research, *India, *Pantnagar(India), *Piezometric contour maps, Finite difference equations.

A method for determining the storage coefficient of an aquifer using piezometric contour maps was presented. The method is based on the transient groundwater flow equation simplified and reduced to finite difference form. Since drilling of observation wells is expensive and time consuming, this procedure is particularly useful for preliminary assessment of groundwater resources of an area where no observation wells near the abstraction wells are available. The values of the aquifer storage coefficient in the Pantnagar University Farm area obtained by this method showed good agreement with those obtained by means of pumping tests. (Visocky-ISWS)
W79-08104

ROLE OF UNDERGROUND COMPONENTS IN THE HYDROLOGIC BUDGET OF LAKES AND RESERVOIRS,
Z. A. Vikulina.
Soviet Hydrology: Selected Papers, Vol. 16, No. 3, p 200-207, 1977. 3 fig, 4 tab, 24 ref. Translated from Trudy Gosudarstvennogo Gidrologicheskogo Instituta, No. 240, p 96-112, 1977.

Descriptors: *Groundwater, *Base flow, *Lakes, *Reservoirs, *Hydrologic budget, Inflow, Discharge(Water), Rivers, Storage, Water storage, Hydrogeology, *USSR.

The underground components of the hydrologic budget of inland bodies of water were subdivided according to their participation in the total supply and loss of water, into: (1) groundwater inflow; (2) groundwater outflow; and (3) change in bank storage. The first is the incoming, the second the outgoing, and the third the 'accumulative' component of the hydrologic budget. The most common among underground components of the hydrologic budget of lakes and reservoirs is groundwater inflow. The proportion of groundwater in the total water supply to lakes and reservoirs differs: in large lakes and reservoirs with basins in the lowland regions of the excessively wet zone, groundwater inflow is insignificant and does not exceed several per cent of the total supply. The groundwater inflow to many large mountain, piedmont, and steppe lakes is commensurate with surface inflow, while it is one of the main gain components of the budget of small lakes in arid regions. Groundwater inflow is significant in the hydrologic budget of bog lakes and, under otherwise equal conditions, its share is greater in lakes with a relatively large drainage area. Groundwater inflow can also be considerable in deeply-entrenched small lakes in the excessively wet zone, the small tributaries of which do not drain the entire thickness of the aquifers. (Sims-ISWS)
W79-08105

DETERMINATION OF THE INITIAL 14C ACTIVITY OF THE TOTAL DISSOLVED CARBON: A REVIEW OF THE EXISTING MODELS AND A NEW APPROACH,
Paris-6 Univ. (France). Lab. de Geologie Dynamique.
J-C. Fontes, and J-M. Garnier.
Water Resources Research, Vol. 15, No. 2, p 399-413, April 1979. 5 fig, 6 tab, 44 ref.

Descriptors: *Carbon radioisotopes, *Groundwater, *Model studies, *Mathematical models, Reviews, Radioactive dating, Carbon, Isotope studies, Dissolved solids, Carbon dioxide, Carbonates, Chemistry, Water chemistry, Geochemistry, Hydrology, Carbon dating, Hydrochemistry.

Carbon 14 age calculations are based upon the assumption that the initial activity of the material to be dated was 100% of modern CO2 activity (100 pmc). This assumption is generally good for material of organic origin (wood and, to some extent, shells). Dissolved carbon in groundwater has two main sources; active carbon from the soil zone and less active (or even 'dead') carbon of inorganic origin. Furthermore, the existence of a three-phase system (gaseous CO2 and aqueous and solid carbon) allows significant isotopic exchange. The estimation of the initial activity of the total dissolved carbon requires the use of a model. Existing models for the determination of the initial 14C activity (A sub o) of total dissolved carbon are (1) Vogel's model (A sub o = 85 + or - 5% of modern carbon), (2) Tamers' model (A sub o is the activity of dissolved carbon of organic origin diluted by dissolved carbon of inorganic origin), (3) Pearson's model (A sub o is the mixing of these same sources of carbon, evidenced by their stable isotope content), and (4) Mook's model (same as Tamers' model plus a correcting term accounting for an isotopic exchange in closed system with aqueous CO2). A new model was presented which assumes the simple mixing of the end-members of the system (gaseous CO2 and solid carbonate). (Sims-ISWS)
W79-08106

CHARACTERISTICS OF THE INTERACTION BETWEEN RIVER AND GROUND WATERS IN MOUNTAIN REGIONS,
A. Z. Amus'ya.
Soviet Hydrology: Selected Papers, Vol. 16, No. 3, p 193-199, 1977. 2 fig, 11 ref. Translated from Transactions of the State Hydrologic Institute (Trudy GGI), No. 240, p 73-85, 1977.

Descriptors: *Groundwater, *Mountains, *Rivers, *Geomorphology, Classification, Streams, Karst, Regions, Topography, Hydrogeology, Recharge, Aquifers, Natural recharge, Springs, Foreign research, Foreign countries, Water sources, *Piedmont plains.

In the absence of quantitative characteristics of the hydrodynamic interaction of river water with groundwaters in mountain regions, one must use indirect characteristics, derived from an analysis of various physiographic information, to describe this interaction. This paper described the main characteristics of this interaction under various geomorphological conditions in mountain regions with reference to groundwater inflow. Account was taken of the character of the relief, its degree of dissection, and other physiographic characteristics, including hydrogeological conditions, the description of which is supplemented by an analysis of data on the groundwater regime. Geomorphological zones discussed included: (1) high-mountain, deeply dissected (alpine) relief; (2) medium-mountain relief (peripheral parts of high mountains and individual mountain systems, uplands in folded mountain regions); (3) suppressed volcanic relief; (4) weakly (and moderately) dissected high-mountain relief; (5) foothills; and (6) piedmont plains. The descriptions of the conditions of formation of groundwater inflow gave the most general qualitative idea of the characteristics of interaction of river with groundwaters in the most typical kinds of relief of mountain countries. Various local forms of relief develop depending on the stability of rocks on slopes and water-divide ridges and also in the valleys of mountain rivers. In determining groundwater inflow into specific rivers, allowance should be made for the characteristics of dissection of microrelief forms in the investigated drainage basin, which forms affect the general features of the hydrodynamic interaction between river and groundwaters. (Humphreys-ISWS)
W79-08211

SEEPAGE STREAMS OUT OF CANALS AND DITCHES OVERLYING SHALLOW WATER TABLES,
California Univ., Santa Barbara. Dept. of Mechanical and Environmental Engineering.
J. C. Bruch, Jr.
Journal of Hydrology, Vol. 41, No. 1/2, p 31-41, April 1979. 2 fig, 1 tab, 8 ref.

Descriptors: *Seepage, *Canal design, *Water table, Ditches, Drainage, Groundwater, Hydrology, Porous media, Shallow water, Streams, Mathematical studies, *Shallow water table, Water logging, Baiocchi method, Seepage streams.

When there is seepage from a canal or ditch overlying a shallow water table, waterlogging of the

soil at distant points is a distinct possibility. Thus, for given flowfield parameters, it is desirable to be able to predict the limit of the drainage capacity whic can be handled without producing this condition of waterlogging at distant points. A simple numerical scheme was presented for the solution of such problems. This numerical scheme, based upon the Baiocchi method and transformaton, gives a quick, simple, and accurate means of obtaining the discharge and the free-surface location knowing the physical parameters of the particular canal or ditch problem. Thus, the data necessary to investigate the waterlogging phenomenon for a particular flow situaton can readily be obtained from the application of this numerical approach. The numerical results obtained for specific applications were compared with other published results to similar problems. Also, a discussion was presented concerning the numerical results and the performance of the numerical scheme. (Lee-ISWS)
W79-08250

THE RANGE OF WATER TEMPERATURE FLUCTUATIONS IN THE LIMESTONE WATERS OF THE CENTRAL AND SOUTHERN PENNINES,
A. F. Pitty, R. A. Halliwell, J. L. Ternan, P. A. Whittel, and R. G. Cooper.
Journal of Hydrology, Vol. 41, No. 1/2, p 157-160, April 1979. 1 fig, 10 ref.

Descriptors: *Groundwater, *Springs, *Water temperature, *Fluctuations, Variability, On-site investigations, On-site data collections, Caves, Subsurface waters, Underground streams, Temperature, Air temperature, Hydrogeology, *England.

As part of geomorphological research into fluvial processes, seasonal fluctuations in several variables have been measured for a large number of streams and risings in the limestone areas of northern England. Apart from a preliminary, general coverage of 37 sites in NW Yorkshire which were visited 12-16 times, and the North York Moor sites which were visited on 18 or more occasions, most of the remaining sites were visited on at least 24 occasions over a one- or two-year period. In most cases, water temperatures estimated to 0.01C were taken as close as practicable to the point of emergence. As very slight modification of the water temperature by air temperature close to the emergence point remains an inevitable possibility, in addition to other possible sources of operator and instrument variance and the effect of time of day when sampling occurred, the standard deviations were reported as upper limits of the true variability of underground water. The data was presented in two histograms. Of the risings, the modal class is that of the narrowest temperature range, with standard deviations of less than 0.20C. Groundwaters once incorporated in to surface flow temperature fluctuations is 3.40-3.59C. Significantly, virtually all risings fall on the narrower side of this mode. Thus, some groundwater component in surface flows with temperature ranges narrower than s.d. = 3.40C may be postulated. (Sims-ISWS)
W79-08253

INERT GASES IN GROUNDWATER FROM THE BUNTER SANDSTONE OF ENGLAND AS INDICATORS OF AGE AND PALAEOCLIMATIC TRENDS,
Bath Univ. (England). School of Chemistry.
J. N. Andrews, and D. J. Lee.
Journal of Hydrology, Vol. 41, No. 3/4, p 233-252, May 1979. 6 fig, 4 tab, 28 ref.

Descriptors: *Groundwater, *Gases, *Paleoclimatology, *Isotope studies, Radioactive dating, Radioisotopes, Radium radioisotopes, Uranium radioisotopes, Helium, Sandstones, Aquifers, Recharge, Hydrology, Paleohydrology, Climatology, *England, *Nottinghamshire(England), Inert gases, Thorium.

A study of the radiogenic and atmospherically derived inert gases in groundwaters from the Bunter Sandstone aquifer of Nottinghamshire, England, was described. The radiogenic gases, 222Rn and 4He, were derived by decay of the radioelements contained in the aquifer. The relationship between radioelement content of the rock and groundwater 222Rn and 4He contents was discussed. An increase in the dissolved 4He content with groundwater age was demonstrated and correlated with 14C ages. Excess 4He ages calculated from average physical properties and radioelement contents of the aquifer rock were greater than the corrected 14C ages, and possible explanations for this were discussed. The dissolved Ar and Kr contents of the groundwaters indicated their temperature of air equilibration in the unsaturated zone at recharge. The recharge temperatures for groundwaters of age greater than 20,000 yr. are 5-7C lower than those for waters recharged in the last 10,000 yr. This was shown to be consistent with the palaeoclimatic record for England during the late Pleistocene. (Sims-ISWS)
W79-08254

PREDICTION OF NON-DARCY FLOW IN POROUS MEDIA,
British Columbia Univ., Vancouver.
J. de Vries.
Journal of the Irrigation and Drainage Division, American Society of Civil Engineers, Vol. 105, No. IR2, Proceedings Paper 14610, p 147-162, June 1979. 7 fig, 1 tab, 19 ref, 2 append.

Descriptors: *Darcys law, *Groundwater, *Porous media, Permeability, Model studies, Equations, Flow, Groundwater movement, Viscous flow, Reynolds number, Efficiencies, Permeameters, Instrumentation, Hydraulic gradient, *Non-Darcy flow, Inertial forces, Glass beads.

Equations were derived that facilitate prediction of both the onset of non-Darcy flow in a porous medium and the viscous and inertia force fractions of the hydraulic gradient dp/ds after non-Darcy flow has begun. The equations are based on measurements of hydraulic gradients, dp/ds, and corresponding fluxes, q, carried out with a permeameter in both the Darcy and non-Darcy flow regions on 0.8-mm to 1.4-mm and 0.4-mm to 0.6-mm glass beads and sand. Hydraulic resistivities, r, were calculated from dp/ds and q. The value of r(q) was found to be linear in the non-Darcy region. This linearity was used to determine the value of a non-Darcy flow parameter, e. Its value was found to be 0.7 for glass beads and 0.9 for sand. At the onset of non-Darcy flow, 94.7% and 5.3% of dp/ds were used in viscour and inertia force flow, respectively. Calculations require knowledge of both the intrinsic permeability and e for the porous stratum under consideration. A value of e = 0.9 was suggested for materials found in the field. (Visocky-ISWS)
W79-08263

ARTIFICIAL GROUNDWATER RECHARGE AND ITS RELEVANCE IN BRITAIN,
Water Research Centre, Medmenham (England). Medmenham Lab.
For primary bibliographic entry see Field 4B.
W79-08266

ZONALITY OF GROUND-WATER RUNOFF UNDER HUMID CONDITIONS,
V. N. Ostrovskiy.
Soviet Hydrology: Selected Papers, Vol. 16, No. 3, p 184-192, 1977. 5 fig, 1 tab, 39 ref. Translated from Trudy Gosudarstvennogo Gidrologicheskogo Instituta, No. 240, p 32-50, 1977.

Descriptors: *Groundwater recharge, *Base flow, *Humid areas, *Europe, Soils, Soil water, Groundwater, Infiltration, Evaporation, Permeability, Precipitation(Atmospheric), Rivers, Runoff, Mapping, *USSR.

In humid lowland regions, the areal zonality of groundwater recharge through infiltration in the zone of active water exchange, the evaporation of groundwaters, and their runoff depend mainly on landscape-climatic factors. A quantitative relation has been established between the coefficients of zonal groundwater runoff and the atmospheric moisture deficit in the European USSR. The magnitude of the zonal groundwater runoff in humid lowland regions is determined also by net radiation, the aridity index, and precipitation. The structure of an equation relating groundwater runoff with these meteorological elements for the European USSR has been identified. In lowland regions, azonal factors (geology and relief) are superposed on the latitudinal zonality of groundwater runoff, but they do not change it significantly. (Sims-ISWS)
W79-08284

HYDROGEOLOGIC FACTORS AFFECTING THE AVAILABILITY AND QUALITY OF GROUND WATER IN THE TEMPLE TERRACE AREA, HILLSBOROUGH COUNTY, FLORIDA,
Geological Survey, Tallahassee, FL. Water Resources Div.
J. W. Stewart, C. L. Goetz, and L. R. Mills.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-295 841, Price codes: A04 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 78-4, 1978. 38 p, 11 fig, 4 tab, 7 ref.

Descriptors: *Groundwater availability, *Aquifer characteristics, *Water quality, Water yield, Hydrogeology, Groundwater movement, Surface-groundwater relationships, Water supply, Florida, *Temple Terrace area, Hillsborough County.

Ground water occurs in two aquifers in the Temple Terrace area of Hillsborough County, Fla. The lower one is the artesian Floridan aquifer; the upper is the water-table aquifer. The Floridan aquifer is a thick sequence of limestone and dolomite layers which include several permeable zones that generally are treated as a single hydrologic unit. The top of the Tampa Limestone is considered to be the top of the Floridan in the Temple Terrace area. The public supply wells of the city tap the Tampa Limestone and the underlying Suwannee Limestone, in the upper part of the Floridan. The general direction of ground-water movement in the Floridan aquifer is from north to south, but within the city the direction of movement is from northeast to southwest. The quantity of water moving southwest through a 1.8 mile section of the aquifer is about 2.7 million gallons per day. Ample supplies of water in a cavernous limestone, considered to be the most productive water-yielding zone in the aquifer, are available for additional development from the Floridan aquifer. Water-quality data are included also. (Woodard-USGS)
W79-08385

HYDROGEOLOGIC FEATURES OF THE ALLUVIAL DEPOSITS IN THE GREYBULL RIVER VALLEY, BIGHORN BASIN, WYOMING,
Geological Survey, Cheyenne, WY. Water Resources Div.
For primary bibliographic entry see Field 7C.
W79-08391

HYDROLOGIC DATA FOR WATER-TABLE AQUIFERS IN THE GREATER DENVER AREA, FRONT RANGE URBAN CORRIDOR, COLORADO,
Geological Survey, Lakewood, CO. Water Resources Div.
For primary bibliographic entry see Field 2A.
W79-08394

WATER RESOURCES OF THE NORTHERN UINTA BASIN AREA, UTAH AND COLORADO, WITH SPECIAL EMPHASIS ON GROUND-WATER SUPPLY,
Geological Survey, Salt Lake City, UT. Water Resources Div.
For primary bibliographic entry see Field 7C.
W79-08395

WATER IN THE DAKOTA FORMATION, HODGEMAN AND NORTHERN FORD COUNTIES, SOUTHWESTERN KANSAS,
Geological Survey, Lawrence, KS. Water Resources Div.
For primary bibliographic entry see Field 4D.
W79-08396

THE OLIGOCENE AQUIFER SYSTEM IN MISSISSIPPI,
Geological Survey, Jackson, MS. Water Resources Div.
For primary bibliographic entry see Field 7C.
W79-08399

2G. Water In Soils

EFFECT OF DIFFERENT-ELECTROLYTE LEACHING WATERS ON HYDRAULIC CONDUCTIVITY AND E.S.P. OF IDKU SOILS, A.R.E.,
Alexandria Univ. (Egypt). Dept. of Soil and Water Science.
H. M. A. Bakr, A. M. Fathy, and S. E. A. Awadallah.
Alexandria Journal of Agricultural Research, Vol. 26, No. 2, p 481-487, 1978. 5 tab, 11 ref.

Descriptors: *Hydraulic conductivity, *Leaching, *Saline water, *Ion transport, *Cation exchange, Soil chemical properties, Soil physical properties, *Electrolytes, Irrigation effects, Permeameters, Water properties, Electrochemistry, Salts, Sodium compounds, Alkalinity, Egypt.

Tests were conducted on soil samples from the Mediterranean coastal desert area northeast of Alexandria, Egypt, to determine effects of different electrolyte leaching waters on soil hydraulic conductivity and exchangeable sodium percentages (ESP). To verify the importance of salt concentrations of leaching water on the chemical and physical properties of soils for productive use, experiments were set up to simulate soils of differing alkalinities, with each set of samples subjected to 1 or 4 leaching treatments of variable electrolyte concentrations. Results indicated that the transmission rate of water through alkali soils depends upon the electrolyte concentration of the leaching water, with reductions in hydraulic conductivity being more pronounced when leaching with water containing monovalent cations than those with divalent. It is concluded that soils having high exchangeable sodium percentages can be reclaimed by leaching with successive dilutions of highly saline water. (Tickes-Arizona)
W79-08013

RELATIONS BETWEEN SOME PHYSICAL AND CHEMICAL FACTORS AFFECTING HYDRAULIC CONDUCTIVITY OF EDKO SOILS, A.R.E.,
Alexandria Univ. (Egypt). Dept. of Soil and Water Science.
A. M. Fathy, H. M. A. Bakr, and S. A. Awadallah.
Alexandria Journal of Agricultural Research, Vol. 26, No. 2, p 467-472, 1978, 3 tab, 17 ref.

Descriptors: *Cation exchange, *Soil physical properties, *Soil chemical properties, *Hydraulic conductivity, Chemical reactions, Egypt, Clay minerals, Cation adsorption, Chemical properties, Soil analysis, Electrical conductance, Soil structure, Correlation analysis, Regression analysis.

Various cations appearing either on the soil complex as exchangable cations or in the soil solution as soluble cations, play an important role in determining the physical and chemical soil properties which affect hydraulic conductivity. For the purpose of the present study, five undisturbed soil samples were collected from four different profiles and locations according to their color or texture to determine the relationship between hydraulic conductivity and (1) electrical conductivity, (2) structure factor, (3) large pores percentages and (4) dispersion ratio. Results indicated a positive linear relationship between large pore percentage and exchangable calcium percentage and a negative linear relationship between large pore percentage and exchangable sodium percentage. These results reflect the stability of clay aggregates with an increase in the structure factor. Accordingly, the relationship between hydraulic conductivity and the structure factor was found to be positive and linear while the dispersion ratio was negative and linear. The effect of undispersed clay on decreasing hydraulic conductivity was lower than that of dispersed clay although both were found to be in a negative and linear relationship with hydraulic conductivity. (Tickes-Arizona)
W79-08016

SOIL MOISTURE: A MULTIDISCIPLINARY PROBLEM,
Central Road Research Inst., New Delhi. Soil Mechanics Div.
P. Jagannatha Rao.
Transactions of Indian Society of Desert Technology and University Centre of Desert Studies, Vol. 2, No. 2, p 185-189, Dec 1977. 6 ref.

Descriptors: *Soil moisture, *Soil-water-plant relationships, *Soil physical properties, *Soil water movement, Soil water, Soil physics, Theoretical analysis, Rainfall disposition, Environmental effects, Thermal properties, Saline soils.

Although it frequently appears in arid regions that soil moisture changes are unlikely to take place in quantities that are of significance to engineering activities, numerous case histories, field studies and experimental investigations have proven otherwise and aroused the interest of civil engineers. Some of theoretical methods available for solving the problems of soil moisture in relation to civil engineering and their limitations are discussed in this paper. The problems analysed include: (1) the determination of water table, rainfall, temperature and other environmental conditions in relation to soil type and moisture movement, (2) how to predict the rate and quantity of moisture movement under various boundary conditions and in different types of soils, and (3) how to predict the amount of volume change associated with above moisture movement. Of vital significance in solving these problems are the determination of the amount of water in the soil, the movement of this water in response to various osmotic, electrical and thermal gradients, and the associated movement of salts, heat and electricity. (Tickes-Arizona)
W79-08030

MASS TRANSFER IN POROUS MEDIA WITH IMMOBILE WATER,
Vrije Univ., Brussels, (Belgium).
F. De Smedt, and P. J. Wierenga.
Journal of Hydrology, Vol. 41, No. 1/2, p 59-67, April 1979. 5 fig, 17 ref.

Descriptors: *Mass transfer, *Boundary processes, *Porous media, *Mathematical models, Solutes, Leaching, Dispersion, Convection, Theoretical analysis, Equations, Convolution integral, Immobile water fraction.

An analytical solution was presented for the movement of a solute through a porous medium, which is leached at a constant rate. The solution takes into account diffusion into an immobile water fraction. The generalized solution is valid for both finite or semi-infinite media and for concentration or flux-type boundary conditions. The solution consists of a convolution integral of two functions. The first function is the derivative vs. time of the corresponding solutions of the solute transfer equation without lateral diffusion. The second function is the J-function, for which a series approximation was developed. The use of the solution was illustrated with displacement studies in a 30 cm long column, filled with glass beads. It was shown that effluent concentration distributions from, and solute concentration distributions inside the column, when unsaturated, cannot be explained without taking into account an immobile water fraction. (Visocky-ISWS)
W79-08101

AN ITERATIVE METHOD FOR CALIBRATING A MULTICELL AQUIFER MODEL,
Hydrological Service of Israel, Jerusalem.
Y. Bachmat, and A. Dax.
Water Resources Research, Vol. 15, No. 2, p 305-312, April 1979. 10 fig, 2 tab, 5 ref.

Descriptors: *Model studies, *Aquifers, *Algorithms, *Least squares method, *Aquifer characteristics, Water levels, Rainfall, Storage coefficient, Transmissivity, Mathematical models, Equations, *Inverse problem, *Multicell models, Aquifer models, Israel, Iterative method, Quadratic programming, Objective function.

The inverse problem was formulated as a linear least squares problem. Lower and upper bounds on the parameters were added to ensure hydrologic plausibility. The proposed algorithm utilized the special structure of the problem to enable efficient handling of models which are composed of a large number of cells. An example of calibrating a 241-cell model of the coastal aquifer of Israel with the proposed algorithm was presented. (Visocky-ISWS)
W79-08102

ISOTOPE AND ION GEOCHEMISTRY OF GROUNDWATERS IN THE MILK RIVER AQUIFER, ALBERTA,
Alberta Univ., Edmonton. Dept. of Geology.
F. W. Schwartz, and K. Muehlenbachs.
Water Resources Research, Vol. 15, No. 2, p 259-268, April 1979. 8 fig, 1 tab, 27 ref.

Descriptors: *Geochemistry, *Groundwater, *Stable isotopes, *Artesian aquifers, *Canada, Groundwater recharge, Geologic units, Oxygen isotopes, Deuterium, Cation exchange, Spatial distribution, Meteoric water, Mixing, Water chemistry, Outcrops.

The Milk River artesian aquifer underlines an area of approximately 6300 sq km in southern Alberta. Analysis of stable isotope and major ion data for water samples collected from the aquifer revealed a variety of striking patterns. Oxygen-18 and deuterium concentrations for groundwater from the recharging portion of the aquifer fall very close to the meteoric water line, indicating that they are isotopically unaltered meteoric waters. Proceeding down-dip in the aquifer, groundwaters become enriched isotopically to a maximum of 70 and 12 parts per thousand with respect to deuterium and oxygen-18 in the recharging waters. In addition, a systematic deviation (slope of 6.1 instead of 8) from the meteoric water line is also apparent. The most plausible explanation of these isotopic patterns is based on a process of dispersion or mixing on a regional scale. Waters probably enriched with respect to the isotopic composition of the aquifer recharge may be present and simply are being displaced by meteoric water, the aquifer recharge may be present and simply are being displaced by meteoric water, or leakage may have entered the aquifer from below progressively comprising an increased proportion of the aquifer water. This same type of mixing process appears to exert a major control on the major ion chemistry of the aquifer. In addition, chemical processes such as mineral dissolution and cation exchange play a role. (Visocky-ISWS)
W79-08103

AN ELECTRONIC ANALOG FOR UNSATURATED FLOW AND ACCUMULATION OF MOISTURE IN SOILS,
Institute for Land and Water Management Research, Wageningen (Netherlands).
G. P. Wind, and A. N. Mazee.
Journal of Hydrology, Vol. 41, No. 1/2, p 69-83, April 1979. 11 fig, 3 ref.

Descriptors: *Analog models, *Unsaturated flow, *Soil moisture, Soil physical properties, Equations, Electronic equipment, Infiltration, Runoff, Ponding, Moisture content, Drainage, Integrated flow equation, Ohms law, The Netherlands, Layered model.

An electronic analog model of the unsaturated zone has been developed, based on the similarity between the integrated flow equation and Ohm's law. The main difference between the two equations is compensated for by amplifiers. The model simulates one day in 2 s. There are 10 normal layers, each with adjustable magnitude. Moreover, there is a top layer in which infiltration, ponding, and runoff are simulated, and a drain layer with adjustable drain intensity. The normal layers contain an adjustable resistor for the connection with

another layer and a function generator for the k (theta) relation. There are two transition layers which have to be placed at the boundary between two layers of different soil properties. Under saturated conditions, the model is acting incorrectly, so that a too small thickness of the saturated layers is calculated. This can be compensated for by using an equivalent drain intensity which is lower than the real one. The model can be used to simulate the effect of natural rainfall and evaporation on moisture content at every depth. Soil physical properties and drainage conditions can be adjusted. Homogeneous as well as layered soil can be represented by the model. In particular, it can be applied to investigate the drainage requirements of soil. Some examples of the applicability of the model and short technical description were presented. (Visocky-ISWS)
W79-08141

SEEPAGE STREAMS OUT OF CANALS AND DITCHES OVERLYING SHALLOW WATER TABLES,
California Univ., Santa Barbara. Dept. of Mechanical and Environmental Engineering.
For primary bibliographic entry see Field 2F.
W79-08250

THE DESIGN OF A PORTABLE RAINFALL SIMULATOR INFILTROMETER,
Dundee Univ. (Scotland). Dept. of Geography.
A. S. Tricker.
Journal of Hydrology, Vol. 41, No. 1/2, p 143-147, April 1979. 3 fig, 6 ref.

Descriptors: *Infiltrometers, *Rainfall simulators, *Equipment, Rainfall, Simulated rainfall, Infiltration, Infiltration rates, Runoff, Design, On-site investigations, On-site collections, Soil physics, Soil properties, Soil science.

The construction of a hand-portable rainfall simulator infiltrometer was described. The rainfall simulator infiltrometer described can be carried, set up, and operated conveniently by one man and offers a fast, economical means of measuring infiltration capacity. It requires only 1.5-2 man hours per measurement, and thus 3-4 measurements may be accomplished in a day. (Sims-ISWS)
W79-08252

PORE DISTRIBUTION AND PERMEABILITY OF SILTY CLAYS,
CH2M Portland, OR.
I. Garcia-Bengochea, C. W. Lovell, and A. G. Altschaeffl.
Journal of the Geotechnical Engineering Division, American Society of Civil Engineers, Vol. 105, No. GT7, Proceedings Paper 14686, p 839-856, July 1979. 7 fig, 2 tab, 39 ref, 2 append.

Descriptors: *Permeability, *Pores, *Clays, Porous media, Fabrics, Soil water, Soil water movement, On-site investigations, Laboratory tests, Mercury, Data processing, Soils, Model studies, Mathematical models, Soil science, Pore size distribution.

This investigation utilized pore size distribution measurements to examine the relationship between permeability and compactive variables for laboratory compacted clayey silts. Closed-system falling head permeability tests under back pressure were performed on each of the compacted samples. Freeze drying was successfully used to dehydrate specimens prior to pore size measurements. The mercury intrusion technique was used to determine the pore size distribution. The pore size distributions of the soils tested were biomodal, with a large pore mode occurring between 10 micrometers and 1 micrometer and a small pore mode occurring at 0.1 micrometer. Varying the compaction variables produced changes in the size and frequency of the large pore mode, but caused no change in the pore size distribution about the small pore mode for a given soil type. Three theoretical permeability models that relate pore size distribution parameters to permeability were generated. These parameters were successfully used to determine empirical permeability prediction equations for the soils tested. (Sims-ISWS)
W79-08264

INVESTIGATION OF VERTICAL MOISTURE TRANSPORT IN THE UPPER LAYERS OF UNDRAINED HIGHMOOR BOGS BY MEANS OF RADIOACTIVE ISOTOPES,
V. I. Surovov.
Soviet Hydrology: Selected Papers, Vol. 16, No. 3, p 179-183, 1977. 3 fig, 4 tab, 8 ref. Translated from Trudy Gosudarstvennogo Gidrologicheskogo Instituta, No. 236, p 57-65, 1977.

Descriptors: *Soil water movement, *Bogs, *Isotope studies, Moisture content, Soils, Soil water, Water transfer, Infiltration, Capillary water, Capillary conductivity, Hydraulic conductivity, Peat, Organic matter, Organic soils, *USSR.

Vertical moisture transport was investigated by means of radioactive isotopes using trivalent iron chelate, Fe59, as a label for water in May-August 1968. Two monoliths measuring 20 x 20 x 50 cm were taken from a thinly pine-wooded sphagnum-subshrub-cotton grass microlandscape and from a sphagnum-subshrub-pine microlandscape of Lammin-Suo bog for experiments on the movement of water in the upper layers of the peat deposit during evaporation. The peat deposit consisted mainly of 5% decomposed fuscum peat. The method developed for investigating the vertical movement of water and the volumetric radio-indicator method made it possible to determine several characteristics (the layer-by-layer rate of water flow and discharge, the amount of water retained in a layer) describing the vertical moisture transport. The dependence of the rate of transport of labeled water on time was determined by means of the characteristics obtained. It was shown that the zone of water evaporation in the active layer can be determined. From the experimental data, it follows that water evaporates from the capillaries of the upper boundary of the capillary zone in a thinly pine-wooded sphagnum-subshrub-cotton grass landscape and that water is removed from the leaves of the upper-most layer during evaporation and the evaporation zone recedes into the next layer in a sphagnum-subshrub-pine microlandscape. (Sims-ISWS)
W79-08278

ZONALITY OF GROUND-WATER RUNOFF UNDER HUMID CONDITIONS,
For primary bibliographic entry see Field 2F.
W79-08284

RELATIONS BETWEEN AVAILABLE WATER STORAGE CAPACITY AND PERCENTAGE CONTENTS OF SAND, SILT, CLAY AND CACO IN SOME CALCAREOUS SANDY SOILS AT NORTHWESTERN LIMIT OF NILE DELTA,
Alexandria Univ. (Egypt). Dept. of Soils and Water.
H. M. A. Bakr.
Alexandria Journal of Agricultural Research, Vol. 26, No. 2, p 473-480, 1978, 2 tab, 14 ref.

Descriptors: *Soil water, *Soil moisture, *Sands, *Silts, *Clays, *Calcium carbonate, *Calcareous soils, Sampling, Field capacity, Wilting point, Correlation analysis, Regression analysis, Soil texture, Soil profiles, Nile Delta.

Although much information is presently available concerning the conventional moisture contents of Egyptian calcareous soils, a complete study of the factors affecting this variable has yet to be carried out. Accordingly, this author reports here his quantitative assessment of the effects of the percentage contents of sand, silt, clay and calcium carbonate on the available water storage capacity in 84 sandy calcareous soils collected from the northwestern limit of the Nile Delta. Samples taken from 16 profile pits opened in the West Noubaria and North Tahrir areas were crushed, composited for each soil layer, and passed through a 2 mm sieve. Available moisture storage, calcium carbonate content and mechanical composition for all soil samples were determined and subjected to statistical analysis. Results indicated a positive correlation between available water capacity and percentage content of silt, clay and calcium carbonate and a negative correlation with sand. Relationships between clay sand and percentage moisture content at field capacity and permanent wilting point were indicated from highly significant correlation coefficients and it is suggested that calcium helps improve the storage capacity in coarse textured soils by the formation of silt-sized micro aggregates. (Tickes-Arizona)
W79-08292

GROUNDWATER SOURCES LOCATED BY FRACTURE TRACE TECHNIQUE,
Pennsylvania State Univ., University Park. School of Forest Resources.
W. F. Sharpe, and R. P. Parizd.
Water and Sewage Works, Vol. 126, No. 5, p 38-40, May 1979. 3 fig, 2 tab, 5 ref. OWRT A-005-PA(9). 14-34-001-8040.

Descriptors: *Groundwater, *Exploration, *Hydrogeology, Fractures(Geologic), Mapping, Surveys, Locating, Terrain analysis, Groundwater resources, Aquifers, Remote sensing, Aerial photography, Cracks.

By studying black and white or color aerial photographs, hydrogeologists can determine the location of fracture traces by looking at the surface alignment of sags and depressions, soil tonal differences in plowed fields, and differences in vegetation patterns. These land features, difficult to distinguish on the ground, can be seen rather easily from the air. A skilled individual can map 100 acres of land in a few minutes. These fractures, or cracks, are clustered in zones ranging 5 to 50 feet wide and several thousand feet to more than a mile in length. Each fracture zone may contain from 1 to 200 separate fractures or cracks, with 5 or 10 fractures or zones of fracture in any 100 acre area. Once the fractures are mapped on the aerial photograph, the hydrogeologist takes it into the field to determine where the fractures are located on the ground. The precise location of a fracture intersection is determined from ground reference points identified on the photographs and is marked appropriately for the well driller. By drilling precisely on this intersection point, the chances of obtaining a good supply of water are greatly increased. Aerial photographs suitable for fracture-trace mapping are available for the entire U.S. Normally, they can be borrowed from the Agricultural Stabilization and Conservation Service or the Soil Conservation Service office located in almost every county. (Humphreys-ISWS)
W79-08338

INTERRELATIONS OF THE PHYSICAL PROPERTIES OF COPPICE DUNE AND VESICULAR DUNE INTERSPACE SOILS WITH GRASS SEEDLING EMERGENCE,
Texas A and M Univ., College Station. Dept. of Range Science; and Max C. Fleischmann Coll. of Agriculture, Reno NV. Renewable Natural Resources Div.
M. K. Wood, W. H. Blackburn, R. E. Eckert, and F. F. Peterson.
Journal of Range Management, Vol. 31, No. 3, p 189-192, May 1978, 4 tab, 3 fig, 13 ref.

Descriptors: *Seeds, *Dunes, *Aeolian soils, *Moisture stress, *Soil physical properties, *Crop response, *Vegetation establishment, Infiltration rates, Sedimentation, Organic matter, Soil-water-plant relationships, Soil water movement, Hydrologic properties, Soil mechanics.

Characterized by high silt content, low organic matter, and poor aggregation, surficial vesticular horizons have been found to be a major contributing factor to low infiltration rates, sediment production, and sparse vegetation in many arid and semiarid rangelands throughout the world. Soil samples from the Coils Creek Watershed in Nevada were analyzed to characterize some of the physical attributes of coppice dune interspace soils, and to determine the influence of organic matter removal in vesicular development and the effect of a vesicular horizon on seedling emergence. Results indicated that seedling emergence of crested wheatgrass (Agropyron desertorum) and squirrel

tail (Sitanion hytrix) was poor and seedling stress high in vesicular dune interspace soil while the removal of organic matter from coppice dune soils resulted in a poorly aggregated vesicular soil with similar properties as those of untreated interspace soils. (Tickes-Arizona)
W79-08348

NITROGEN POOLS AND FLUXES IN A GEORGIA SALT MARSH,
Georgia Univ., Sapelo Island. Marine Inst.
E. Haines, A. Chalmers, R. Hanson, and B. Sherr.
In: Estuarine Processes, Volume II, Circulation, Sediments, and Transfer of Material in the Estuary, M. Wiley, editor, Academic Press, New York, N. Y., 1976, p 241-254. 3 fig, 2 tab, 42 ref.

Descriptors: *Nitrogen, *Salt marshes, *Georgia, *Soils, Marshes, Wetlands, Rooted aquatic plants, Vegetation, Seasonal, Roots, Denitrification.

Preliminary data on standing stocks of nitrogen and on rates of nitrogen fixation and denitrification in Spartina alterniflora salt marshes on the Georgia coast have yielded a general concept of the nitrogen cycle in this system. The Georgia salt marsh is characterized by fine-textured clay soils, a tidal amplitude of two meters, and high rates of primary production throughout the year. Most combined nitrogen in the system is in the soils in forms not readily available to primary producers. The amounts of exchangeable ammonium, nitrate, and nitrite are small and change seasonally. The presence of nitrate and nitrite in the soil implies that nitrification occurs in the aerobic microzones around Spartina roots. The annual input to the marsh via nitrogen fixation and other quantified sources of nitrogen is as large as the seasonal accumulation of nitrogen by Spartina growth; the input is balanced by the loss of nitrogen via denitrification. The nitrogen input to the marsh is, however, smaller than the estimated nitrogen flux through the marsh plants. Thus, mineral regeneration must satisfy a large part of the nitrogen requirements of Spartina and benthic algae in the Georgia salt marsh. (Stihler-Mass)
W79-08477

2H. Lakes

TRANSIENT RESERVOIR-AQUIFER INTERACTION,
Northeastern Univ., Boston, MA. Dept. of Civil Engineering.
A. D. Koussis.
Journal of the Hydraulics Division, American Society of Civil Engineers, Vol. 105, No. HY6, Proceedings Paper 14630, p 637-645, June 1979. 3 fig, 6 ref, 1 append.

Descriptors: *Reservoirs, *Aquifers, *Groundwater, *Model studies, Mathematical models, Numerical analysis, Analytical techniques, Equations, Groundwater movement, Permeability, Profiles, Porous media, Drawdown, Flow, Hydrology.

The moving boundary problem of the interaction of a reservoir-aquifer system was studied. The nonlinear partial differential equation (PDE) of Boussinesq was used to describe the transient flow conditions in the semi-infinite, unconfined aquifer. The method of solution involved discretization of only the time derivative to obtain an ordinary differential equation (ODE) in space. The resulting ODE was integrated analytically once, and the remaining initial value problem was solved numerically. The solution developed was of the similarity type. The cases of sudden drawdown and buildup were considered, and computed dimensionless profiles vs. dimensionless similarity parameter were compared with experimental data, exact-analytical, linear-analytical, and numerical solutions for different boundary values. Also, analytical relationships for the exchange flows and flow volumes were derived. (Sims-ISWS)
W79-08100

ROLE OF UNDERGROUND COMPONENTS IN THE HYDROLOGIC BUDGET OF LAKES AND RESERVOIRS,
For primary bibliographic entry see Field 2F.
W79-08105

IRRIGATION RESERVOIR THAT SILTS UP INSIGNIFICANTLY,
G. A. Urlapov.
Soviet Hydrology: Selected Papers, Vol. 16, No. 3, p 256-258, 1977. 2 fig, 1 tab, 8 ref. Translated from Gidrotekhnika i Melioratsiya, No. 6, p 34-38, 1977.

Descriptors: *Reservoirs, *Sediments, *Irrigation, *Design, Dams, Embankments, Reservoir silting, Flood plains, Rivers, Lakes, Irrigation water, Storage, Water storage, Sedimentation rates, Sedimentation.

The service life and efficiency of reservoirs depend largely on their rate and character of silting, which is affected not only by the hydrologic regime of the river and operating conditions of the reservoir, but also by its design. When constructing reservoirs for irrigation, there is no need to pass the entire runoff through them. It is sufficient to store the excess runoff with respect to the volume of water consumed in the lower pool. In this case, it is also inadvisable to pass the excess flood and transient runoff through the filled reservoir. The proposed design of a valley-type reservoir consists of two parts: channel and floodplain. River water first enters the channel part of the reservoir, where it clarifies because of the settling of part of the suspended load, and then the floodplain part enters through a lateral spillway at the floodplain edge of the river channel. The sill of this spillway rises above the bottom of the channel so that it prevents bottom sediments from entering the floodplain part of the reservoir and reduces the amount of suspended sediments that enter it. (Sims-ISWS)
W79-08142

SOME PROBLEMS OF THE METHOD OF MEASUREMENT OF HYDROCHEMICAL ELEMENTS BY AUTOMATIC STATIONS,
For primary bibliographic entry see Field 5B.
W79-08146

LONG-RANGE FORECAST OF THE STRENGTH OF THE MELTING ICE COVER IN THE VOLGOGRAD RESERVOIR IN SPRING,
For primary bibliographic entry see Field 2C.
W79-08151

SETTLING BEHAVIOR OF NATURAL AQUATIC PARTICULATES,
Chicago Univ., IL. Dept. of Geophysical Sciences.
For primary bibliographic entry see Field 2J.
W79-08238

THE 210PB CHRONOLOGY OF A CORE FROM MIRROR LAKE, NEW HAMPSHIRE,
Yale Univ., New Haven, CT. Dept. of Geology and Physics.
For primary bibliographic entry see Field 2J.
W79-08239

THE SPATIAL VARIABILITY OF COASTAL SURFACE WATER TEMPERATURE DURING UPWELLING,
Wisconsin Univ.-Madison. Marine Studies Center.
F. L. Scarpace, and T. Green, III.
Journal of Physical Oceanography, Vol. 9, No. 3, p 638-643, May 1979. 9 fig, 12 ref. NSF 33140.

Descriptors: *Lakes, *Lake Superior, *Great Lakes, *Water temperature, *Upwelling, Winds, Coasts, Shores, Variability, Spatial distribution, Distribution patterns, On-site investigations, Remote sensing, Water circulation, Data processing, Analytical techniques, Limnology.

Thermal scanner imagery acquired during a field experiment designed to study an upwelling event in Lake Superior was investigated. Temperature data were measured by the thermal scanner, with a spatial resolution of 7 m. These data were correlated with temperatures measured from boats. One- and two-dimensional Fourier transforms of the data were calculated, and temperature variances as a function of a wavenumber were plotted. A k to the (-3) power dependence of the temperature variance on wavenumber was found in the wavenumber range of 1 to 25 per km. At wavenumbers more than 25 per km, a k to the (-5/3) power dependence was found. (Sims-ISWS)
W79-08256

ENRICHMENTS OF ZINC, LEAD, AND COPPER IN RECENT SEDIMENTS OF WINDERMERE, ENGLAND,
Lancaster Univ., Bailrigg (England). Dept. of Environmental Sciences.
For primary bibliographic entry see Field 5B.
W79-08257

MODELING ICE REGIME OF LAKE ERIE,
Ecology and Environment, Inc., Buffalo, NY.
For primary bibliographic entry see Field 2C.
W79-08262

GENERAL FUNCTIONS AND VALUES OF FRESHWATER WETLANDS IN THE GLACIATED MIDWEST,
Eastern Michigan Univ., Ypsilant. Dept. of Geography and Geology.
E. Jaworski, J. R. McDonald, S. McDonald, and C. N. Raphael.
Prepared for Wetlands Science and Technology Workshop, Kellogg Biological Station, Hickory Corners, Michigan, September 12-16, 1977. Protection Agency Sponsored by U.S. Army Corps of Engineers and Environmental, 1977. 69 p.

Descriptors: *Freshwater marshes, *Central U.S., *Value, Wetlands, Marshes, Aesthetics, Productivity, Marsh plants, Wildlife habitat, Hydrologic aspects, Geochemistry, Biological properties.

An overview of the functional characteristics and economic values of inland wetlands is presented. Wherever available, key references concerning detailed studies or summarial publications are cited. Discussion focuses on the freshwater wetlands of the glaciated Midwest and includes riverine, lakeshore, and non-surface draining wetlands. Wetland functions covered are biological, hydrological, and biogeochemical. Values discussed include agricultural, commercial fisheries, recreational, and cultural and natural. (Steiner-Mass)
W79-08275

LEGENDS OF A DEAD SEA,
Weizmann Inst. of Science, Rehovoth (Israel). Dept. of Isotope Research.
A. Nissenbaum.
Rehovot, Vol. 8, No. 3, p 30-35, Spring 1978, 4 fig.

Descriptors: *History, *Paleohydrology, *Chemical properties, *Physical properties, *Saline lakes, Geologic history, Buoyancy, Water properties, Sea water, Dead Sea.

The Dead Sea has been a subject of intense mystery and interest throughout recorded history. This unique sea, located on the lowest spot of the earth's surface, is distinguished by its combination of sterile heavy water, sulphurous springs, desolate landscape, and scorching summer heat. These unique physicochemical properties have been aided by man's imagination to form the basis for numerous stories and myths concerning both the sea itself and activities precipitated by its existence. Both historical and geological evidence indicate that this huge evaporation pond, which today contains the highest total dissolved salt content of any permanent body of water, has been hypersaline for at least the past 2000 years. Although there are few Biblical references to this body of water, ancient writers made frequent references to it, portraying it as containing fire, asphalt, and sulfer, and describing it as the cause of the ruin of no less than 13 cities. Equally mysterious are the numerous stories concerning both the sea's unusual buoyancy and the well known account of the transformation of Lot's wife into a pillar of salt. Although such portrayals persisted into the late 19th century, sci-

entific data has largely replaced them, and today this region is characterized by irrigation projects and thriving agricultural settlements. (Tickes-Arizona)
W79-08346

THE EFFECTS OF FIRE ON THE ECOLOGY OF THE BOREAL FOREST, WITH PARTICULAR REFERENCE TO THE CANADIAN NORTH: A REVIEW AND SELECTED BIBLIOGRAPHY,
Canadian Wildlife Service, Delta (British Columbia).
For primary bibliographic entry see Field 4C.
W79-08483

2I. Water In Plants

RESPONSE OF CORN TO LIMITED IRRIGATION ON SANDY SOILS,
Nebraska Univ., North Platte. Dept. of Agricultural Engineering.
G. D. Wilson, D. G. Watts, and P. E. Fischbach.
Paper No. 78-2554, Presented at the 1978 Winter Meeting of the American Society of Agricultural Engineers, December 18-20, 1978, Chicago, Illinois, 11 p. 6 fig, 5 tab, 3 ref, 1 equ, 3 append. ASAE, St. Joseph, Michigan.

Descriptors: Moisture deficit, *Irrigation effects, Growth stages, Plant populations, Yield equations, Corn, Crop production.

The objective was to provide information for producers to enable them to make sound decisions concerning irrigation management when water is limited. Five irrigation management systems were evaluated on a Valentine very fine and (Typic Ustipsamment) in North Central Nebraska in 1977 and 1978. Two management systems included limited irrigation. The latter were subdivided into three treatments each in 1977 providing a total of six discrete limited irrigation treatments. Another treatment was added in 1978 making a total of seven limited irrigation treatments. In each year, the limited irrigation treatments were compared to nonirrigated and fully irrigated checks. Significant water savings were achieved with the limited irrigation treatments. Yield variation from full irrigation yields ranged from 4750 kg/ha reductions to 900 kg/ha increases. As much as 12.2 cm of irrigation water were saved with no yield reduction, even though water use was reduced. (Skogerboe-Colorado State)
W79-08008

RESPONSES OF A STANDARD AUSTRALIAN AND A MEXICAN WHEAT TO TEMPERATURE AND WATER STRESS,
Commonwealth Scientific and Industrial Research Organization Canberra (Australia). Div. of Plant Industry.
J. L. Davidson, and J. W. Birch.
Australian Journal of Agricultural Research, Vol. 29, No. 6, p 1091-1106, Nov. 1978, 7 fig, 3 tab, 30 ref.

Descriptors: *Crop response, *Wheat, *Drought tolerance, *Soil-water-plant relationships, *Consumptive use, *Moisture stress, Crop production, Irrigation effects, Water utilization, Water requirements, Heat resistence, Differential thermal analysis, Varieties, Environmental effects, Efficiencies, Flowering.

Effects of temperature and water stress treatments imposed after anthesis on 2 varieties of spring wheat, Australian Gabo and Mexican Pitic 62, were studied to determine environmental factors on crop yields. Post treatment dry matter contents taken as biological indices of 9 simulated environments indicated that grain yields of Pitic 62 were consistently higher than those of Gabo. Characteristics believed to contribute to this are: (1) by anthesis this variety produced larger ears from a given weight of supporting tissue, and (2) after anthesis, it mobilized a higher percentage and amount of stem and leaf material to increase the grain production. Two broad categories of shoots were distinguishable and harvest index values varied with both shoot category and size of shoot or plant. The first 4 shoots of both varieties were water-stress tolerant and experienced stress only after anthesis, while younger shoots experienced stress earlier in development and were found to be stress sensitive. In terms of water use, dry matter production, and grain yield, both varieties were found to be similar in response to both temperature and water stress, with highest yields occuring at 21/16 C and water use efficiencies increasing with decreasing water supplies. (Tickes-Arizona)
W79-08015

DROUGHT RESISTANCE IN SPRING WHEAT CULTIVARS. I GRAIN YIELD RESPONSES,
Centro Internacional de Mejoramiento de Maiz y Trigo, Mexico City.
R. A. Fischer, and R. Maurer.
Australian Journal of Agricultural Research, Vol. 29, No. 5, p 897-912, September 1978, 3 fig, 7 tab, 18 ref.

Descriptors: *Drought tolerance, *Plant physiology, *Soil-water-plant relationships, *Crop response, *Wheat, *Varieties, Dry farming, Crop production, Consumptive use, Plant growth, Irrigation effects, Barley, Environmental effects, Moisture stress, Physiological ecology, Grains(Crops), Water utilization, Mexico.

This study of specific drought resistence mechanisms of several varieties of wheat under cultivation in arid northwest Mexico was conducted over three seasons by permanently terminating irrigation at various stages before anthesis. Detailed measurements of plant water status, leaf area, dry matter production, anthesis date, yield components, and grain yield were made. Results indicate a linear relationship between cultivar yield and drought intensity, with mean yield of all cultivars ranging from 37-86 percent of the control yield. This corresponds to irrigation cutoffs, varying from 69 days before mean anthesis date, to only 10 days prior. A consideration of cultivar yield under drought as a function of yield potential, drought susceptibility, and intensity of drought indicates that tall bread wheats and barleys had the highest drought resistance values, while dwarf bread wheats were intermediate, and durum wheats and triticales the most susceptible. Dwarf wheats, however, did have a higher yield potential than tall bread wheats, suggesting that only under severe drought conditions can tall bread wheats outyield the dwarfs. Highly significant differences of grain yield under drought appear to be constant between years, and in agreement with international trials under dryland conditions. (Tickes-Arizona)
W79-08017

RESIDUAL EFFECTS OF SUMMER IRRIGATION ON MOJAVE DESERT ANNUALS,
California Univ., Riverside. Dept. of Biology.
H. B. Johnson, F. C. Vasek, and T. Yonkers.
Bull. Southern California Academy of Sciences, Vol. 77, No. 3, p 95-108, 1978. 1 fig, 6 tab, 36 ref.

Descriptors: *Irrigation effects, *Crop response, *Environmental effects, Irrigation efficiency, Crop production, Consumptive use, Vegetation effects, Environmental gradient, Vegetation establishment, Germination, Annuals, Vegetative communities, Mojave Desert, Soil-water-plant relationships, Sprinkler irrigation, Rainfall, Slopes, Creosote bush, Shrubs.

Two distinct groups of annual appear to have evolved in the deserts of southwestern North America: the summer annuals which germinate in response to sufficient precipitation during periods of high temperature, and the winter annuals that germinate in response to sufficient precipitation during periods of low temperature. Because the progression of events which lead to the conditions required for the germination and development of these annuals has been a concern of botanists through the years, the purpose of the present study was to determine the response of summer and winter annuals to early summer irrigation and/or natural rainfall on both a rocky slope and a sandy bajada near east Ord Mountain in the Mojave Desert, California. Two sites representing different phases of the creosotebush scrub community were selected for sprinkler irrigation from an imported 450-gallon tank which together with two summer storms in the area made it possible to analyze the results of a combination of irrigation and natural rainfall treatments. Somewhat unexpected results indicated that irrigation stimulated germination in summer annuals on the rocky slope but not on the bajada where a late summer storm produced a progression of annuals while during the following season winter annuals showed markedly reduced densities on both irrigated plots and on the area receiving summer rain, annuals which comprised over 80% of the plant species in both sites exhibit greater spatial heterogenity than the perennial communities and it was concluded that summer precipitation may have a greater influence upon vegetation response than has been previously supposed. (Tickes-Arizona)
W79-08019

THE EFFECTS OF SALINE IRRIGATION WATER AND GYPSUM ON PERENNIAL PASTURE GROWN ON A SODIC, CLAY SOIL AT KERANG, VICTORIA,
Victoria Dept. of Agriculture, Kerang.
For primary bibliographic entry see Field 5C.
W79-08020

GENERAL FUNCTIONS AND VALUES OF FRESHWATER WETLANDS IN THE GLACIATED MIDWEST,
Eastern Michigan Univ., Ypsilant. Dept. of Geography and Geology.
For primary bibliographic entry see Field 2H.
W79-08275

INTERRELATIONS OF THE PHYSICAL PROPERTIES OF COPPICE DUNE AND VESICULAR DUNE INTERSPACE SOILS WITH GRASS SEEDLING EMERGENCE,
Texas A and M Univ., College Station. Dept. of Range Science; and Max C. Fleischmann Coll. of Agriculture, Reno NV. Renewable Natural Resources Div.
For primary bibliographic entry see Field 2G.
W79-08348

EFFECT OF IRRIGATION INTERVAL AND PLANT POPULATION ON GROWTH, YIELD AND WATER USE OF SOYBEANS IN A SEMI-ARID ENVIRONMENT,
New South Wales Dept. of Agriculture, Leeton.
J. A. Thompson.
Australian Journal of Experimental Agriculture and Animal Husbandry, Vol. 18, No. g1, p 276-281, April 1978, 4 tab, 4 fig, 14 ref.

Descriptors: *Irrigation practices, *Water management(Applied), *Irrigation effects, *Timing, *Plant populations, *Crop response, *Plant growth, *Environmental effects, *Soybeans, Water utilization, Consumptive use, Planting management, Productivity, Rates of application.

Reported are the results of an experiment conducted to examine the effects of two irrigation intervals and three plant populations on yield and water use of soybeans in a semi-arid environment at the Leeton agricultural Research Station, New South Wales. An experimental design in which plant populations of 12, 20, and 28 plants per square meter were furrow-irrigated at irrigation intervals of 70 mm and 140 mm of estimated evapotranspiration was used to indicate that while plant population had little influence upon plant performance or water use, highly significant differences were found between the two irrigation intervals. A 34 percent reduction in seed yield was indicated at the 140 mm interval principally due to a decrease in the number of pods per plant, and little effect on either protein or oil content of the seed was found. Water use was found to be 75 percent of pan evaporation under the 70 mm interval and 15 percent lower under the 140 mm interval, although protein and seed production was less efficient under the latter. While peak soil moisture demands appear to coincide with the end of flowering early

pod fill period, more work is required to define the growth stage at which soybeans are most sensitive to soil water conditions. (Tickes-Arizona)
W79-08365

GRASSLAND PRODUCTIVITY: THE DESERT END OF THE CURVE,
Transvaal Museum, Walvis Bay (South Africa). Desert Ecological Research Unit.
M. K. Seely.
South African Journal of Science, Vol. 74, No. 8, p 295-297, August 1978, 4 fig, 1 tab, 18 ref.

Descriptors: *Soil-water-plant relationships, *Plant growth, *Productivity, *Crop response, *Regression analysis, Water requirements, Grasslands, Rainfall, Namib desert.

Numerous studies of the relationship between rainfall and plant production have been carried out to date in Southwest Africa, Australia, and Tunisia where annual precipitation ranges from 100 to 1500 mm. The purpose of the present paper is to describe this relationship in the extremely low rainfall region of the Central Namib Desert along the southwestern coast of Africa and to compare it with results obtained in other desert areas. Simple rain gauges were erected during the summer of 1973-74 at 2 km intervals extending 44 km ENE from Gobabeb along a transect intersecting the area where the western boundary of the grass cover may occur. In March 1974, following an unusually heavy rainfall, five 1-meter-square quadrants were clipped at ground level near each rain gauge along the transect and standing crop was measured and related to rainfall. Results indicated values of 0 to 49.9 g m2 for rainfall varying from 11 to 96 mm with an average dry matter of 0.5 mg dry matter g1. Comparison of these regression lines with those obtained 40 years earlier for nearly grasslands experiencing higher annual precipitation, and those of a decade earlier for numerous sources of varied rainfall regimes indicate that the regression line slopes are significantly different. (Tickes-Arizona)
W79-08366

WATER AWARE-II: LANDSCAPING AND IRRIGATION TECHNIQUES TO CONSERVE WATER. OUTDOOR RESIDENTIAL WATER CONSERVATION HINTS FOR ARIZONA HOUSEHOLDS,
Water Resources Research Center, Tucson, AZ. Arizona Water Resources Project Information, Project Bulletin No. 20, June 1979, 1 fig, 8 ref.

Descriptors: *Landscaping, *Planting management, *Vegetation establishment, *Water conservation, *Plant groupings, Water requirements, *Irrigation efficiency, Soil-water-plant relationships, Irrigation practices, Water reuse, Arizona.

Landscaping attitudes and traditions brought to the Southwestern U.S. from Spain and Mexico which utilized the concept of water as a limited resource have largely been displaced by attitudes transplanted from water-abundant regions in the Eastern and central U. S. The impending culture shock induced by water scarcity which has resulted is discussed here, with emphasis upon outdoor residential water conservation hints for Arizona households. Included are helpful suggestions concerning landscape design criteria, landscape plant selection, irrigation tips, irrigation methods, and the potential utilization of recycled water. Design function and general water requirements are categorized by: Space defining plants, Shade and shelter, Foundation plants, Groundwater plants, Vines, Bedding plants, and Accent. (Tickes-Arizona)
W79-08370

CLIPPING OF WATER-STRESSED BLUE GRAMA AFFECTS PROLINE ACCUMULATION AND PRODUCTIVITY,
Illinois Univ. at the Medical Center, Chicago. Dept. of Biological Sciences.
K. Wisiol.
Journal of Range Management, Vol. 32, No. 3, May 1979, p 194-195, 2 tab, 17 ref.

Descriptors: *Crop response, *Cutting management, *Moisture stress, *Grama grasses, *Amino acids, Drought tolerance, Range management, Pasture management, Range grasses, Halophytes, Proteins, Proline.

Proline, a protein component classed with the amino acids, has been observed to accumulate to abnormal levels in many species of water-stressed vernalized or halophytic plants. To determine if this proline accumulation can be used to indicate the regrowth potential of range grass, proline concentration and productivity were measured in 8 month old blue grama (Bouteloua gracilis) plants grown from Lovington-variety seed from New Mexico and subjected to water stress, clipping, or both in two growth chamber experiments. Results indicated that clipping of plants prior to water stress reduced proline accumulation in the bases of the stressed shoots and increased herbage production, while post water stress clipping speeded up the accumulation of proline in the shoot bases. (Tickes-Arizona)
W79-08375

GRAZING ON WETLAND MEADOWS,
Georgia Univ., Brunswick. Marine Resources Extension Center.
For primary bibliographic entry see Field 4C.
W79-08469

MANAGEMENT OF WETLANDS FOR WILDLIFE HABITAT IMPROVEMENT,
Louisiana State Univ., Baton Rouge. School of Forestry and Wildlife Management.
R. H. Chabreck.
In: Estuarine Processes, Volume I, Uses, Stresses and Adaptation to the Estuary, M. Wiley, editor, Academic Press, New York, N. Y., 1976, p 226-233. 28 ref.

Descriptors: *Wetlands, *Wildlife, *Habitat, *Management, Coastal marshes, Water levels, Salinity, Ditches, Birds, Mammals, Foods, Aquatic weeds, Rooted aquatic plants.

Population levels of sporting and commercial wildlife species occupying wetlands are a product of the quantity and quality of habitat available. The rapid loss or modification of wetland habitat by other land-use practices has increased the need for special management to maintain or improve habitat quality. Habitat management practices should be designed to regulate the species composition, density, and distribution of plants. Major factors affecting plant growth in coastal wetlands are water levels and salinity, and the management practices applied should be those best suited to local conditions for maintaining these variables within acceptable limits. Special attention must be given to other needs of the wildlife species involved, because factors other than plants are also important components of favorable habitat. Management practices currently used in coastal wetlands are shallow water impoundments, water control structures in drainage systems, marsh ditches, and artificial potholes. Other treatments frequently applied are marsh burning, herbicidal treatment, and planting. (Stihler-Mass)
W79-08470

CRAFT INDUSTRIES FROM COASTAL WETLAND VEGETATION,
Miami Univ., Coral Gables, FL.
J. F. Morton.
In: Estuarine Processes, Vol. I, Uses, Stresses and Adaptation to the Estuary, M. Wiley, editor, Academic Press, New York, N.Y., 1976, p 254-266. 31 ref.

Descriptors: *Wetlands, *Vegetation, *Rooted aquatic plants, *Industrial production, Trees, Grasses, Cattails, Ferns, Industries.

Useful coastal plants have long been prized. The portia tree, Thespesia populnea, and the related mahoe, Hibiscus tiliaceus, both yield useful wood and inner bark. Mangroves provide nearly indestructible wood, flexible branches for fish traps and tannin for dyes. The leather fern Acrostichum, furnishes edible fiddleheads and tough fronds for thatching. In the East Indies and Polynesia, Pandanus tectorius is an indispensable source of leaf products. Much building material in the form of woven matting is supplied by palms. The moriche, Mauritia flexuosa, is the main fiber provider in the Orinoco delta. Cattails, Typha spp., are utilized in many ways on a worldwide scale. Sedges and grasses have served widely for hut-building, thatching, screens, matting, baskets, brooms and cordage. (Stihler-Mass)
W79-08472

PHARMACOLOGICAL POTENTIAL OF MARSH PLANTS,
Mississippi State Univ., Mississippi State. Dept. of Chemistry.
D. H. Miles, and A. A. de la Cruz.
In: Estuarine Processes, Volume I, Uses, Stresses, and Adaptation to the Estuary, M. Wiley, editor, Academic Press, New York, N.Y., 1976, p 267-276. 4 fig, 3 tab, 14 ref.

Descriptors: *Rooted aquatic plants, *Marshes, *Public health, Wetlands, Tidal marshes, Pharmacology, Cancer.

The alkaloids in three species of vascular plants abundant in Mississippi tidal marshes were analyzed. An unexpectedly high amount (2.0 g/kg) of total alkaloidal fraction was found in adult Juncus roemerianus and as much as 1.5 g/kg in Spartina cynosuroides and Scirpus americanus. Indole was also identified in the volatile constituents of S. cynosuroides. Since two of the most potent antileukemic agents are dimeric indole alkaloids, crude extracts from these plants were sent to the National Cancer Institute for screening of their possible antitumor activity. These tests have resulted in the detection of significant activity in 12 species of marsh plants. Further examination of the extract of J. roemerianus has resulted in the isolation of the new tumor inhibitor, juncusol. Antitumor agents are currently being isolated from the other marsh plants which have demonstrated significant activity. (Stihler-Mass)
W79-08473

TRACE METAL CYCLES IN SEAGRASS COMMUNITIES,
Texas Univ. at Austin, Port Aransas. Port Aransas Marine Lab.
W. Pulich, S. Barnes, and P. Parker.
In: Estuarine Processes, Volume I, Uses, Stresses, and Adaptations to the Estuary, M. Wiley, editor, Academic Press, New York, N. Y., 1976, p 493-506. 4 fig, 4 tab, 17 ref.

Descriptors: *Metals, *Rooted aquatic plants, *Wetlands, Iron, Manganese, Zinc, Copper, Nutrients, Texas, Seasonal, Seagrass.

Processes which make essential trace metals, as well as other nutrients, readily available may account for the distribution of and patterns of succession in seagrass meadows. Complete inventories of Fe, Mn, Zn, and Cu were compared for the five species of Texas seagrasses from study areas in Redfish Bay and Northern Laguna Madre. Seasonal fluctuations in an area were minimal, while major areal differences between plants in Laguna Madre and Redfish Bay were detected. The seagrasses from Laguna Madre contained more Mn and less Fe (Halodule lead avg. Fe/Mn ratio = 0.37, avg. Mn = 250 ppm) than Redfish Bay plants (Halodule leaf avg. Fe/Mn ratio = 4.0, avg. Mn = 90 pps), although sediments from Laguna Madre had 50% lower concentrations of leachable (i.e. 'available') Fe and Mn than Redfish Bay sediments. Measurements showed that seagrass detritus remained high in the 4 trace metals; thus unless the detritus is recycled at its source of production, large amounts of metals will be removed from the ecosystem. We suggest that recycling of detritus and gradual release of nutrients into the water column in the closed Laguna Madre system may be more advantageous to seagrass growth than increased levels of trace metals in the sediments of a more open system such as Redfish Bay. (Stihler-Mass)
W79-08475

NUTRIENT EXCHANGES BETWEEN BRACKISH WATER MARSHES AND THE ESTUARY,
Horn Point Environmental Lab., Cambridge, MD.
J. C. Stevenson, D. R. Heinle, D. A. Flemer, R. J. Small, and R. A. Rowland.
In: Estuarine Processes, Volume II, Circulation, Sediments, and Transfer of Material in the Estuary, M. Wiley, editor, Academic Press, New York, H. N. Y., 1976, p 219-240. 8 fig, 1 tab, 42 ref.

Descriptors: *Nutrients, *Marshes, *Estuaries, Wetlands, Nitrogen, Oxygen, Phosphorus, Respiration, Photosynthesis, Brackish water, Chesapeake Bay.

A 5.7 ha marsh on the Choptank River was monitored monthly from October 1974 to August 1975 for dissolved inorganic nitrogen and phosphorus. During these diurnal samplings, nutrient exchange with the estuary was eliminated by a tidal gate and total aquatic oxygen metabolism was measured. During winter, photosynthesis exceeded respiration, and total nitrogen increased to 80 microgram atoms/l and declined through spring to 8 microgram atoms/l. Phosphate varied erratically from 0.8 to 4.3 microgram atoms/l. During winter, there appears to be a net flow of inorganic nitrogen and phosphorus to the estuary. In spring this pattern is reversed. Two years' tidal flow data from a 127 ha marsh on the Patuxent River revealed that dissolved inorganic nitrogen is also taken up in May, June and July. When the dissolved organic fraction is also considered, net nitrogen flow was always to the estuary. Estimated nitrogen flux to the estuary was 4.14 g/sq m/hr. Net annual flux of dissolved phosphorus to the estuary was 0.19 g/sq m/yr. Brackish marshes appear to act more as sources of nutrients to the estuary than do high salinity marshes. (Stihler-Mass)
W79-08476

NITROGEN POOLS AND FLUXES IN A GEORGIA SALT MARSH,
Georgia Univ., Sapelo Island. Marine Inst.
For primary bibliographic entry see Field 2G.
W79-08477

BENTHIC DETRITUS IN A SALTMARSH TIDAL CREEK,
Virginia Univ., Charlottesville. Dept. of Environmental Studies.
J. C. Pickral, and W. E. Odum.
In: Estuarine Processes, Volume II, Circulation, Sediments, and Transfer of Material in the Estuary, M. Wiley, editor, Academic Press, New York, NY., 1976. p 280-292, 5 fig, 1 tab, 30 ref.

Descriptors: *Detritus, *Salt marshes, *Streams, Marshes, Wetlands, Sediments, Seasonal, Vegetation, Storms, Methodology.

A new benthic sampling device was developed to permit convenient, quantitative collection of organic detritus from submerged sediment surfaces. The apparatus was used to investigate the spatial and temporal distribution of benthic detritus in a tidal, saltmarsh creek adjacent to the York River, Virginia. Diurnal, monthly, and seasonal samples were collected and partitioned into detrital size fractions. Each size fraction was analyzed to determine the percentage of root, stem, and leaf tissue contributed by the dominant marsh plants. The standing stock and composition of detritus varied in a characteristic manner across the width and along the length of the tidal creek. Temporal differences were also evident, especially those associated with periodic storms. The data indicate apparent relationships between the morphology of the creek, current velocities, substrate texture, and the distribution and composition of the benthic detritus. (Stihler-Mass)
W79-08478

CARBON RESOURCES OF A BENTHIC SALT MARSH INVERTEBRATE: NASSARIUS OBSOLETUS SAY (MOLLUSCA: NASSARIIDAE),
Georgia Univ., Athens. Dept. of Zoology.
R. L. Wetzel.
In: Estuarine Processes, Volume II, Circulation, Sediments, and Transfer of Material in the Estuary, M. Wiley, editor, Academic Press, New York, N.Y., 1976, p 293-308. 5 fig, 4 tab, 30 ref.

Descriptors: *Mollusks, *Snails, *Carbon, *Salt marsh, Mud flats, Ecology, Microorganisms, Algae, Marshes, Wetlands.

The mud snail, Nassarius obsoletus Say, occupies the intertidal mud flat area of the salt marsh ecosystem at Sapelo Island, Georgia, and is classed as a detritovore. The three principal carbon resources available for ingestion by the intertidal population are Spartina alterniflora Loisel derived carbon (plant detritus), microbial carbon (bacteria), and benthic algae (primarily pennate diatoms). Uptake studies using C14 labeled substrates indicated that the structural carbohydrate fraction (crude fibre) of the plant detritus was not assimilable. Uptake and retention of C14 by N. obsoletus occurred only on microbial and algal labeled substrates. Extrapolating the calculated short term uptake and retention rates to a daily basis for these two carbon resources, total incorporation would balance a daily body carbon loss of 5 to 6%. There was evidence from the uptake studies that N. obsoletus functions more as a 'grazer' on the mud flat area than a strict detritovore. Label uptake was approximately 2.3 times greater on the algal substrate than the microbial and ingestion significantly reduced algal standing crop in the experimental cores. Net carbon retention efficiency for both substrates was 46%. (Stihler-Mass)
W79-08479

CONTRIBUTION OF TIDAL MARSHLANDS TO MID-ATLANTIC ESTUARINE FOOD CHAINS,
Maryland Univ., Solomons. Chesapeake Biological Lab.
D. R. Heinle, D. A. Flemer, and J. F. Ustach.
In: Estuarine Processes, Volume II, Circulation, Sediments, and Transfer of Material in the Estuary, M. Wiley, editor, Academic Press, New York, N.Y., 1976, p 309-320. 3 fig, 3 tab, 30 ref.

Descriptors: *Tidal marshes, *Estuaries, *Anadromous fish, *Copepods, *Foods, Marshes, Coastal marshes, Wetlands, Invertebrates, Detritus, Fish.

The seasonal pulsing of flows of carbon from tidal marshes results in similarly pulsed production of zooplankton in some estuaries. Direct evidence, experimental feeding of laboratory copepods, and measurements of feeding by captured wild copepods, supports the hypothesis that detritus is rapidly incorporated into higher trophic levels. The timing of the production of copepods based on a detrital food source is such that year-to-year variations in amount may be an important factor in the survival of larvae of anadromous fish. (Stihler-Mass)
W79-08480

RIVER PLANTS: THE MACROPHYTIC VEGETATION OF WATERCOURSES,
Cambridge Univ. (England). Botany School.
S. M. Haslam.
Cambridge University Press, Cambridge. 1978. 396 p.

Descriptors: *Aquatic plants, *Rivers, *Ecology, *Ecological distribution, *Rooted aquatic plants, Algae, Vegetation, Submerged plants, Flow, Width, Wetlands, Light, Grazing, Herbicides, Pollution, Dredging, Erosion, Turbidity, Geology, Productivity, Great Britain, Canada, United States.

The effects on the distribution of riverine plants of river width, drainage, order, depth, flow and substrate, light and shading (from above and due to turbidity), siltation and nutrients, surficial geology (soft versus hard rock base) and pollution are discussed in detail. The effects of flow and substrate on individual plants (hydraulic resistance to flow, anchoring strength, velocity pull, battering and tangling, abrasion, root depth and pattern, erosion and sedimentation) are also examined. Most examples are taken from British rivers, but three chapters are devoted to the vegetation within the streambed and to techniques for maintaining watercourses (dredging, plant cutting, herbicides, shading, grazing). Productivity is discussed briefly. A glossary and index are provided. (Stihler-Mass)
W79-08482

THE NATURAL ENVIRONMENTS OF GEORGIA,
Georgia State Univ., Atlanta.
C. H. Wharton.
Geologic and Water Resources Division and Resource Planning Section, Office of Planning and Research, Georgia Department of Natural Resources, Atlanta, 1978. 227 p, 110 fig, 349 ref, 6 append.

Descriptors: *Georgia, *Habitats, *Wetlands, Classification, Springs, Aquifers, Rivers, Streams, Marshes, Salt marshes, Ponds, Bogs, Beaver.

One hundred natural environments of Georgia are discussed including 39 hydric systems (systems where standing or flowing surface water is visible for substantial portions of the day, month or year). Included are various types of springs, river and stream systems, marshes, ponds, swamps, and bogs. Location, description, flora and fauna of each environment are discussed as are natural and cultural values, man's uses and man's impacts. The physiographic classification and paleohistory of Georgia are discussed briefly. Photographs of many environments are included. (Stihler-Mass)
W79-08484

WATER RELATIONS OF PLANT SPECIES IN THE WET COASTAL TUNDRA AT BARROW, ALASKA,
San Diego State Univ., CA. Dept. of Biology.
W. A. Miller, and P. C. Miller.
Arctic and Alpine Research, Vol. 7, No. 2, p 109-124, 1975. 9 fig, 6 tab, 68 ref.

Descriptors: *Rooted aquatic plants, *Tundra, *Ecology, Pacific Coast Region, *Water relations, Alaska, Wetlands, Ponds, Photosynthesis, Stress, Model studies.

Various aspects of the water relations of six species (Arctophila fulva, Dupontia fischeri, Carex aquatilis, Eriophorum angustifolium, Potentilla hyparctica, and Salix pulchra) characteristic of the wet coastal tundra near Barrow, Alaska, were measured during the summers of 1972 and 1973. Lower leaf water potentials occur in the plants of the Barrow area than previously reported. Minimum leaf resistances, cuticular resistances, and threshold water potentials are similar to those of mesic species in alpine and more temperate areas. Arctophila may be confined to ponds and Dupontia to the moist Arctic coast because of stomatal sensitivity to water loss. Midday leaf water potentials low enough to cause some stomatal closure occurred throughout the 1972 season in Dupontia; throughout the 1973 season in Arctophila, Dupontia and Potentilla. Results of this study support the hypothesis that water stress can limit photosynthesis of plants in the wet coastal tundra around Barrow. (Stihler-Mass)
W79-08485

THE EFFECT OF REEDS ON THE WATER CHEMISTRY OF GNADENSEE (BODENSEE),
Baden-Wuerttemberg Landesstelle fuer Gewaesserkunde und Wasserwirtschaftliche Planug, Karlsruhe (Germany, F.R.).
For primary bibliographic entry see Field 2K.
W79-08486

ENERGY CONTENT IN THE BIOMASS OF EMERGENT MACROPHYTES AND THEIR ECOLOGICAL EFFICIENCY,
Ceskoslovanska Akademie Ved. Trebon. Dept. of Hydrobotany.
D. Dykyjova, and S. Pribil.
Archiv fur Hydrobiologie, Vol. 75, No. 1, p 90-108, February, 1975. 5 tab, 30 ref.

Descriptors: *Aquatic plants, *Ecological productivity, *Aquatic habitats, *Communities, Wetlands, Biomass, Solar radiation energy, Energy conversion, Reedswamp.

Energy contents were determined for dominant species in the highly productive reedswamp communities. In the photosynthetic organs, the energy contents are highest in the spring (in the young parts), and may fall during the growing season. Fruits and flowers have a higher energy content than the vegetative part and the belowground storage organs. The calculated efficiency coefficients of incident global radiation are relatively very high. The caloric values are compared with other author's data as well as with the comparable values on floating and submerged macrophytes. (Hinkel-Mass)
W79-08488

SUBMERSED AQUATIC VASCULAR PLANTS IN ICE-COVERED PONDS OF CENTRAL OHIO,
Ohio State Univ., Columbus. Dept. of Botany.
R. L. Stuckey, J. R. Wehrmeister, and R. J. Bartolotta.
Rhodora, Vol. 80, No. 824, p 575-580, October, 1978. 22 ref.

Descriptors: *Rooted aquatic plants, *Winter, *Ponds, Wetlands, Vegetation, Submerged plants, Competition, Life history studies, Ohio.

The presently accepted life histories of many submersed aquatic vascular plants which assume perennation exclusively by various types of specially formed dormant structures deserve re-evaluation. The addition of a slow-growing or dormant phase in the vegetative condition could appropriately be integrated into our present concepts of the life histories of many of these species. The success of some 'weedy' invaders or aggressive competitors may be correlated with their ability to remain in a vegetative condition throughout the winter; with the onset of melting ice, such plants are already active photosynthetically. (Stihler-Mass)
W79-08491

THE ROLE OF SEED BANKS IN THE VEGETATION DYNAMICS OF PRAIRIE GLACIAL MARSHES,
Iowa State Univ., Ames. Dept. of Botany and Plant Pathology.
A. G. van der Valk, and C. B. Davis.
Ecology, Vol. 59, No. 2, p 322-335, early Spring, 1978. 2 fig, 6 tab, 28 ref.

Descriptors: *Freshwater marshes, *Seeds, *Germination, Lakes, Marshes, Wetlands, Rooted aquatic plants, Vegetation, Submerged plants, Succession, Ecology, Mud flats, Iowa, Water level fluctuations, Muskrats.

The presence of viable seed in 24 substrate samples from Eagle Lake, a marsh in northcentral Iowa, was tested by placing subsamples of each sample under two environmental conditions. One set of samples was placed under water (submersed treatment). Seeds of 20 species germinated and grew. There was an average of 8.3 species/sample. The second treatment was a simulation of conditions on an exposed mud flat (drawdown treatment). Under drawdown treatment an average 12.9 species germinated/sample. Seeds of 40 species germinated under this treatment of which only 25 percent were also found in the submersed treatment. Seed banks in the six vegetation types samples were estimated to range from 21,445 to 42,610 seeds/sq m on the average in the upper 5 cm of soil. Field studies at Eagle Lake (1974) and nearby Goose Lake (1976), when these marshes had no standing water, revealed that the most abundant species whose seeds germinated on exposed mud flats were the same as the most abundant species germinating in the drawdown experiment. In 1975 Eagle Lake had standing water and the submersed and floating species that were found were the same as those germinating in the submersed experimental subsamples. (Stihler-Mass)
W79-08492

FUNGI FROM NANTUCKET SALT MARSHES AND BEACHES,
North Carolina Univ. at Chapel Hill. Inst. of Marine Sciences.
R. V. Gessner, and B. J. Lamore.
Rhodora, Vol. 80, No. 824, p 581-586, October, 1978. 21 ref.

Descriptors: *Aquatic fungi, *Salt marshes, *Beaches, Marshes, Wetlands, Fungi, Ecological distribution, Rooted aquatic plants, Aquatic plants, Massachusetts, Nantucket(MA).

The fungi of Nantucket salt marshes and beaches, reported in this limited study, appear to be similar to those of mainland New England. The geographical distribution of the marine fungi reported here appears to be influenced by water temperatures and the distribution of host plants. (Stihler-Mass)
W79-08493

SOME MIDSUMMER DIATOM ASSEMBLAGES ALONG THE SALINE GRADIENT OF A SMALL COASTAL STREAM IN KACHEMAK BAY, ALASKA,
Rutgers - The State Univ., Newark, NJ. Dept. of Botany.
J. D. Koppen, and J. H. Crow.
Botanica Marina, Vol. 21, p 199-206, 1978. 2 fig, 4 tab, 26 ref.

Descriptors: *Alaska, *Diatoms, *Streams, Salinity, Tides, Coastal areas, Algae, Ecological distribution, Ecology.

Silver Creek, a coastal stream, was sampled for mid-summer diatom assemblages. Two upstream stations with a constant supply of freshwater were dominated with oligohalobous and a few euryhalobous forms. Midstream sites were dominated by mesohalobous and euryhalobous taxa indicative of increased brackish water and tidal influence. Dominance by mesohalobous forms at downstream locations along with a substantial decrease in the proportion of euryhalobous forms can be attributed to increased salinity and decreased salinity fluctuations. (Stihler-Mass)
W79-08494

MARL ENCRUSTATION ON HYDROPHYTES IN SEVERAL MICHIGAN LAKES,
Michigan Univ., Ann Arbor. Dept. of Fisheries.
R. G. Wetzel.
Oikos, Vol. 11, No. II, p 223-236, 1960. 2 fig, 1 tab, 70 ref.

Descriptors: *Marl, *Rooted aquatic plants, *Lakes, Wetlands, Submerged plants, Phytoplankton, Periphyton, Bacteria, Alkaline water, Carbonates, Calcium compounds, Ecology, Waves, Michigan.

Representative hydrophyte samples were taken from comparative transects in four bodies of water in southeastern Michigan. The amount of monocarbonate marl deposit per gram of plant material (dry weight) was determined. Among the areas investigated, differences in marl encrustation were slight for like species under similar environmental conditions. Considerable variation in deposition was found among different species. Among emergent and floating hydrophytes, capable of direct utilization of atmospheric carbon dioxide, encrustation on the submerged portions was highly variable and proportional to the extent of development of attached periphyton. Among submerged species, deposits are considerably greater and variations are correlated with several factors including morphological variations and differential bicarbonate utilization. Intraspecific variations were also found, with encrustation increasing with increasing depth on the individual hydrophyte. Mechanical removal of the brittle deposits induced by surface wave action is the primary factor decreasing surface encrustation. Agencies of marl formation are discussed. (Stihler-Mass)
W79-08495

ABOVEGROUND PRODUCTION OF SEVEN MARSH PLANT SPECIES IN COASTAL LOUISIANA,
Louisiana State Univ., Baton Rouge. Dept. of Marine Science.
C. S. Hopkinson, J. G. Gosselink, and R. T. Parrondo.
Ecology, Vol. 59, No. 4, p 760-769, Summer, 1978. 3 fig, 3 tab, 30 ref.

Descriptors: *Primary productivity, *Rooted aquatic plants, *Louisiana, Wetlands, Marshes, Coastal marshes, Biomass, Productivity, Vegetation, Aquatic plants.

Results of a two-year evaluation of above-ground production of 7 plant species commonly found in Louisiana's coastal marshes show a generally higher level of production compared to other studies. In five of the seven species significant growth occurred throughout the year. Calculated annual production in grams per square metre for each species was: Distichlis spicata, 3237; Juncus roemerianus, 3416; Phragmites communis, 2318; Sagittaria falcata, 1501; Spartina alterniflora, 2658; Spartina cynosuroides, 1355; and Spartina patens, 6043. Sampling variability, expressed as the ratio of the standard error to the mean x 100, averaged between 8 and 18 for different species. Instantaneous loss rates (mg/g/day) of dead vegetation from the marsh, averaged over the year, ranged from 4.7 for P. communis to 25.2 for S. falcata. (Stihler-Mass)
W79-08496

VEGETATION AND PRODUCTION OF THE WOODBURY CREEK-HESSIAN RUN FRESHWATER TIDAL MARSHES,
Rutgers - The State Univ., Camden, NJ. Dept. of Biology.
R. E. Good, and N. F. Good.
Bartonia, Vol. 43, p 38-45, 1974-1975. 2 fig, 4 tab, 6 ref.

Descriptors: *Primary productivity, *Rooted aquatic plants, *Tidal marshes, *Freshwater marshes, *New Jersey, Wetlands, Cattails, Wild rice, Standing crops, Energy.

The Woodbury Creek-Hessian Run marshes are strongly dominated by extensive stands of wild rice. Wild rice also occurs in mixtures with spatterdock, bur marigold, water hemp, smartweed and arrowhead. Wild rice is probably the most productive plant of the marshes with peak aboveground standing crop exceeding 1400 g/sq m and peak below-ground standing crop approximating 900 g/sq m. Peak aboveground standing crops for other community types are considerably lower than wild rice, but belowground standing crop of perennial species with rhizomes (Nuphar, Peltandra, Typha) exceed those of wild rice. Aboveground standing crop figures obtained for these marshes are in general agreement with those obtained for similar communities at Tinicum and Oldmans Creek. There are no available belowground data for comparison. Caloric values varied little, regardless of species or plant part, with most figures in the range of 4300 plus or minus 300 calories/g ash-free dry weight. (Stihler-Mass)
W79-08497

THE INFLUENCE OF PREHISTORIC CULTURES UPON THE INITIATION AND SPREAD OF BLANKET BOG IN UPLAND WALES,
Kings Coll., London (England). Dept. of Botany.
For primary bibliographic entry see Field 4C.
W79-08499

INFLUENCE OF AQUATIC MACROPHYTES ON THE CHEMISTRY OF SKADAR LAKE, YUGOSLAVIA,
Michigan Univ., Ann Arbor. Great Lakes and Marine Waters Center.
A. M. Beeton, and S. Sikes.
Verh. Internat. Verein. Limnol., Vol. 20, p 1055-1061, October, 1978. 3 fig, 2 tab, 19 ref.

Descriptors: *Rooted aquatic plants, *Water chemistry, *Lakes, *Effects, Wetlands, Littoral, Vegetation, Water quality, Europe, Yugloslavia.

Skadar Lake fluctuates between 360 sq km and 690 sq km due to heavy runoff from winter and spring rains; extensive areas are flooded annually. These flooded areas and an extensive littoral zone support

large beds of aquatic macrophytes. Approximately 22% of the northern end of that lake in summer is occupied by aquatic macrophytes. The chemistry of the lake is similar to that of the Moraca River, its major tributary, from October into early June. The chemical characteristics of lake water differ from the river after aquatic macrophytes become well established in late spring. At this time, specific conductance and alkalinity are lower in the lake than in the river. Low conductivity values are likely to be the result of photosynthesis. (Stihler-Mass)
W79-08500

2J. Erosion and Sedimentation

DEVELOPMENT AND APPLICATION OF SEDIMENT BASINS IN MARYLAND,
Soil Conservation Service, College Park, MD.
S. M. Boysen.
Paper No. 78-2562, Presented at the 1978 Winter Meeting of the American Society of Agricultural Engineers, December 18-20, 1978, Chicago, Illinois, 13 p. 2 fig, 9 ref, 1 append. ASAE, St. Joseph, Michigan.

Descriptors: *Sediment control, Trap efficiency, Soil erosion, Design criteria, Design standards, Specifications, Sediment yield, *Detention reservoirs, Skimming.

Sediment basins are an important part of the sediment control program in Maryland. Criteria were presented for estimating trap efficiency of basins. Experiences and results of field observations were presented. Standards and specifications prepared by the Soil Conservation Service for sediment basins in Maryland were attached. (Skogerboe-Colorado State)
W79-08006

CURRENT-INDUCED SEDIMENT MOVEMENT IN THE DEEP FLORIDA STRAITS: CRITICAL PARAMETERS,
Rhode Island Univ., Kingston. Graduate School of Oceanography.
For primary bibliographic entry see Field 2L.
W79-08095

DISPERSION ESTIMATES FOR HYDRAULIC DREDGE SPOIL,
Tippetts, Abbett, McCarthy, and Stratton, New York.
M. R. Pyles, and W. L. Schroeder.
Journal of the Environmental Engineering Division, American Society of Civil Engineers, Vol. 105, No. EE3, Proceedings Paper 14625, p 571-582, June 1979. 10 fig, 1 tab, 6 ref, 1 append.

Descriptors: *Dredging, *Sands, *Spoil banks, *Dispersion, Model studies, Mathematical studies, On-site investigations, Waste disposal, Sediments, Sedimentation, Settling velocity, Navigation, Harbors, *Hydraulic dredging.

A method for analysis of the location of sandy dredge spoils on the bottom of a receiving water body was developed and confirmed by laboratory and field experimentation. Analysis of laboratory data using the method indicated agreement with observation where the physical environment (pipeline discharge velocity, ambient water velocity, settling velocity of particles) was well defined. Application to field operations confirmed the laboratory results and showed that the simple form of analysis proposed is consistent with the precision of physical environment definition usually obtainable in dredging practices. (Sims-ISWS)
W79-08097

DYNAMIC MODEL FOR CHANNEL BED EROSION,
Rensselaer Polytechnic Inst., Troy, NY. Dept. of Mathematical Sciences.
D. A. Drew.
Journal of the Hydraulic Division, American Society of Civil Engineers, Vol. 105, No. HY6, Proceedings Paper 14634, p 721-736, June 1979. 2 fig, 18 ref, 1 append.

Descriptors: *Bed load, *Erosion, *Sediment transport, *Model studies, Mathematical models, Sediments, Channels, Rivers, Turbulence, Flow, Channel erosion, Channel improvement, Stabilization, Scour, Hydrodynamics, Fluid mechanics, Bedload movement.

A model for the hydrodynamical description of the flow of sediment and water in a thin layer near the bed was presented. Closer assumptions were given for the turbulence terms. A pickup relation for the concentration of sediment above the bed was examined. The behavior of the model was studied for two different simplifying assumptions about the fluid flow above the bed. (Sims-ISWS)
W79-08098

DYNAMICS OF FORMATION OF THE CHANNEL OF THE KARA-KUM CANAL,
Kh. Sh. Shapiro, and T. A. Aliyev.
Soviet Hydrology: Selected Papers, Vol. 16, No. 3, p 241-244, 1977. 4 fig, 2 tab, 6 ref. Translated from Gidrotekhnika i Melioratisiya, No. 4, p 27-32, 1977.

Descriptors: *Canals, *Channel morphology, *Soil strength, *Erosion, On-site investigations, On-site data collections, Model studies, Mathematical models, Soil erosion, Channels, Soils, Roughness coefficient, Roughness(Hydraulics), Soil science, *Kara-Kum Canal(USSR).

Continuous study of channel processes in the Kara-Kum Canal has yielded extensive experimental data. These data can be used to plan and calculate stable channel forms for diversion of part of the flow of Siberian rivers to Soviet Central Asia. Field investigations in 1973-1976 were conducted in three reaches of a total length of 52 km with 39 cross sections. Furthermore, sample measurements were made in the reach from the 57- to the 100-km mark of the canal. Analysis of field data showed that the stability of the bank slopes of large canals is largely determined by the nature of scouring. For example, as flow increases, bank deformation predominates in the reaches of the canal with sandy soils and vertical deformation in reaches with cohesive soils. The ratio of width to average depth in sandy reaches varies from 40 to 85 and in reaches with cohesive soils from 8 to 25. (Sims-ISWS)
W79-08099

GEOMETRY OF RIVERS IN REGIME,
San Diego State Univ., CA. Dept. of Civil Engineering.
For primary bibliographic entry see Field 2E.
W79-08108

IRRIGATION RESERVOIR THAT SILTS UP INSIGNIFICANTLY,
For primary bibliographic entry see Field 2H.
W79-08142

PROTECTION OF THE BANKS OF THE AMU-DAR'YA RIVER FROM DEYGISH BY HYDROMECHANICAL MEANS,
D. L. Melamut, N. K. Golybev, and N. R. Stetsenko.
Soviet Hydrology: Selected Papers, Vol. 16, No. 3, p 248-252, 1977. 6 fig, 2 tab, 6 ref. Translated from Gidrotekhnika i Melioratsiya, No. 5, p 15-23, 1977.

Descriptors: *Bank protection, *Channel improvement, *Bank stabilization, Bank erosion, Bank stability, Dredging, Rivers, Channels, Embankments, Erosion, Sedimentation, Flow, Hydrology, *Amu-Dar'ya River(USSR).

Intense channel deformation in plan, leading to the catastrophic destruction of the banks, i.e., deygish, is typical of the Amu-Dar'ya River. The fine sandy channel bed and the transverse stalling of flow, associated with sharp discharge and water level fluctuations at flood rise and recession, are responsible for such scour. The concave bank is most susceptible to this process. The erosion products are carried by bottom currents toward the convex bank, where they are deposited and increase the forming shoal. The slope of the eroded bank during deygish is steep and nearly vertical in its upper part. Because of the appearance of cracks in the bank, the earth of the bank collapses into the river. A relatively short cut (2-3 km) with a slope exceeding the slope of the flow in the river by a factor of 1.3-1.5 offers the best conditions for diverting a stream and letting it erode the ground. In widening a cut of considerable length with a flowing stream of water, the sediments must be intercepted by dredges near side and midstream bars. In that case, erosion intensifies. Hydraulic filling is effective when several dredges are used to narrow and close the channel. Hydraulic filling should begin from the bank where the flow is deeper so that the gap is closed in the shallow area. In the final stages of work, along with dredges it is advisable to use bulldozers for moving and dumping earth into the stream from dumps on the banks in order to additionally saturate the flow. (Sims-ISWS)
W79-08145

SETTLING BEHAVIOR OF NATURAL AQUATIC PARTICULATES,
Chicago Univ., IL. Dept. of Geophysical Sciences.
R. R. P. Chase.
Limnology and Oceanography, Vol. 24, No. 3, p 417-426, May 1979. 6 fig, 2 tab, 15 ref.

Descriptors: *Settling velocity, *Sediments, *Laboratory tests, Lakes, Oceans, Stokes law, Freshwater, Saline water, Organic matter, Particle size, Sedimentology, Limnology, Oceanography, Aquatic particulates.

The validity of Stokes Law as an approximation to the drag force on sediments (organic-mineral aggregates) from lacustrine and marine environments was examined under controlled laboratory conditions. The settling characteristics of aggregates in the size range of 5-500 micrometers were inconsistent with a Stokesian assumption. Experiments with distilled, organics-free, and natural waters indicated that aggregate behavior is altered by the presence of naturally occurring surface coatings, solution electrolytes, and dissolved organic substances. Although rotational effects appear unimportant, the above factors combine to produce a reduction in overall nonlinear skin friction which is manifested by up to an order of magnitude increase in velocity over the predicted value for an aggregate of mean dimension (approx. 28.5 micrometers). (Sims-ISWS)
W79-08238

THE 210PB CHRONOLOGY OF A CORE FROM MIRROR LAKE, NEW HAMPSHIRE,
Yale Univ., New Haven, CT. Dept. of Geology and Physics.
K. L. Von Damm, L. K. Benninger, and K. K. Turekian.
Limnology and Oceanography, Vol. 24, No. 3, p 434-439, May 1979. 2 fig, 2 tab, 15 ref. Energy EY-76-S-02-3573.

Descriptors: *Sediments, *Cores, *Lake sediments, *Isotope studies, *New Hampshire, Lead, Uranium radioisotopes, Sampling, Lakes, On-site data collections, Chemicals, Chemical analysis, Laboratory tests, Radioactive dating, Sedimentation, Limnology, *Mirror Lake(NH).

A core from Mirror Lake (New Hampshire) was analyzed in detail for 210Pb and other members of the uranium decay series. The core shows periods of episodic redistribution and deposition of contemporaneously deposited indigenous lake sediment to the site interspersed with periods of constant sediment accumulation at an average rate of 0.16 cm/yr. In this lake, 226Ra does not provide a reasonable chronometric tool. (Sims-ISWS)
W79-08239

TWO SEDIMENT TRAP DESIGNS FOR USE IN SMALL RIVERS AND STREAMS,
Freshwater Biological Association, Dorset (England). River Lab.
J. S. Welton, and M. Ladle.

Limnology and Oceanography, Vol. 24, No. 3, p 588-592, May 1979. 1 fig, 2 tab, 8 ref.

Descriptors: *Sediments, *Rivers, *Sampling, *Equipment, Sedimentation rates, Sediment transport, Currents(Water), Gravels, Bed load, Bed load samplers, Beds under water, Streamflow, Sedimentation, Sedimentology, *Sediment traps.

Two sediment traps designed for use in riverine gravels to assess rates, size, and gross quantities of sedimenting material and each having a collecting area of 40 sq cm are small, easy to construct, and easy to handle. The results of the two types of traps used in the gravel bed of a recirculating channel were compared, and recovery efficiencies were given based on laboratory experiments. (Sims-ISWS)
W79-08242

ORGANIC DETRITUS PARTICLES: INITIATION OF MOTION CRITERIA,
Clemson Univ., SC. Dept. of Civil Engineering.
J. S. Fisher, J. Pickral, and W. E. Odum.
Limnology and Oceanography, Vol. 24, No. 3, p 529-532, May 1979. 1 fig, 1 tab, 18 ref.

Descriptors: *Detritus, *Sediments, *Organic matter, Settling velocity, Sediment transport, Laboratory tests, Mathematical models, Equations, Reynolds number, Drag, Density, Sedimentation, Sedimentology, Motion initiation.

The criteria for the initiation of motion for organic detrital sediments appeared to follow the same Shields relationship as sand and other uniform inorganic sediments. The salt marsh tidal creek samples tested included mud particles and stem, leaf particles, and root fragments of marsh grasses. The measurement of particle diameter was replaced with an equivalent diameter determined from fall velocity and density. (Sims-ISWS)
W79-08243

ENRICHMENTS OF ZINC, LEAD, AND COPPER IN RECENT SEDIMENTS OF WINDERMERE, ENGLAND,
Lancaster Univ., Bailrigg (England). Dept. of Environmental Sciences.
For primary bibliographic entry see Field 5B.
W79-08257

LANDSCAPE REDUCTION BY WEATHERING IN SMALL RHODESIAN WATERSHEDS,
Science and Education Administration, Coshocton, OH.
For primary bibliographic entry see Field 2K.
W79-08269

PREDICTION OF SEDIMENT BASIN PERFORMANCE,
Kentucky Univ., Lexington. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 4D.
W79-08337

2K. Chemical Processes

ISOTOPE AND ION GEOCHEMISTRY OF GROUNDWATERS IN THE MILK RIVER AQUIFER, ALBERTA,
Alberta Univ., Edmonton. Dept. of Geology.
For primary bibliographic entry see Field 2G.
W79-08103

DETERMINATION OF THE INITIAL 14C ACTIVITY OF THE TOTAL DISSOLVED CARBON: A REVIEW OF THE EXISTING MODELS AND A NEW APPROACH,
Paris-6 Univ. (France). Lab. de Geologie Dynamique.
For primary bibliographic entry see Field 2F.
W79-08106

ARSENIC SPECIATION IN SEAWATER AND INTERSTITIAL WATERS: THE INFLUENCE OF BIOLOGICAL-CHEMICAL INTERACTIONS ON THE CHEMISTRY OF A TRACE ELEMENT,
Scripps Institution of Oceanography, La Jolla, CA.
M. O. Andreae.
Limnology and Oceanography, Vol. 24, No. 3, p 440-452, May 1979. 9 fig, 2 tab, 27 ref. ONR N00014-75-C-1052.

Descriptors: *Arsenic compounds, *Sea water, *Connate water, *Pacific Ocean, Chemicals, Chemistry, Chemical analysis, On-site data collections, Sampling, Sediments, Biochemistry, Marine biology, Trace elements, Oceanography, Biology.

Four species of arsenic were found in samples of seawater and interstitial water from the northeast Pacific and the continental borderland off southern California: arsenate, arsenite, methylarsonate, and dimethylarsinate. All were present in the photic zone, with a good correlation between photosynthetic activity and the concentration of the methylated arsenicals. There is less arsenite in the surface waters than in the deep waters, suggesting biological uptake and transport. A sharp increase of arsenate at the base of the photic zone indicates rapid regeneration of this species. In the deep waters arsenate is dominant, but arsenite is still present in excess of equilibrium concentrations. No arsenic biomethylation was found in the interstitial waters of oxic and anoxic sediments, but arsenite was present. In Santa Barbara Basin, arsenite accounts for 20% of the arsenic in the interstitial water, the highest proportion found. Total arsenic is lower in the interstitial than in the overlying waters, suggesting removal of arsenic into the solid phases by adsorption or coprecipitation. Biological-chemical interactions and the kinetics of redox reactions are important in influencing the speciation of arsenic. (Sims-ISWS)
W79-08240

BIOLOGICAL PRODUCTION AND THE EXCHANGE OF OXYGEN AND CARBON DIOXIDE ACROSS THE SEA SURFACE IN STUART CHANNEL, BRITISH COLUMBIA,
Oregon State Univ., Corvallis. School of Oceanography.
K. S. Johnson, R. M. Pytkowicz, and C. S. Wong.
Limnology and Oceanography, Vol. 24, No. 3, p 474-482, May 1979. 7 fig, 1 tab, 28 ref.

Descriptors: *Air-water interfaces, *Oxygen, *Carbon dioxide, Sea water, Atmosphere, Marine biology, Plankton, Photosynthetic oxygen, Oceans, Chemistry, Chemicals, Salinity, Sampling, On-site investigations, On-site data collections, Hydrogen ion concentration, Alkalinity, Oceanography, Biology, Photosynthetic bacteria.

The rates at which concentrations of oxygen and carbon dioxide in Stuart Channel changed due to biological production and to exchange with the atmosphere were determined from measurements of the simultaneous changes in oxygen, pH, and titration alkalinity over a 15-day period in July 1976. Carbon dioxide was consumed by plankton at a rate of 10.8 micromol CO2/liter/d. CO2 entered the surface layer by atmospheric exchange at a range of 0.49 micromol CO2/liter/d. The piston velocity was calculated to be 0.0022 cm/s. Oxygen was produced at a rate of 14.1 micromol O2/liter/d, due to photosynthetic activity. The rate of oxygen loss to the atmosphere was 9.8 micromol O2/liter/d. The piston velocity was 0.0016 cm/s. (Sims-ISWS)
W79-08241

LANDSCAPE REDUCTION BY WEATHERING IN SMALL RHODESIAN WATERSHEDS,
Science and Education Administration, Coshocton, OH.
L. B. Owens, and J. P. Watson.
Geology, Vol. 7, No. 6, p 281-284, June 1979. 2 fig, 6 tab, 17 ref.

Descriptors: *Weathering, *Small watersheds, *Geomorphology, *Granite, *Africa, Rocks, Water quality, Foreign countries, Foreign research, Silica, Iron oxide, Aluminum, Potassium, Sodium, Calcium, Magnesium, Geochemistry, Soil analysis, Topography, Geology, Slopes, *Rhodesia, Chemical weathering.

Two small watersheds were studied to determine rates of dissolution of granite in Rhodesia. One watershed (0.91 sq km) is hilly and has an annual rainfall of 1,220 mm, whereas the other (7.33 sq km) is more nearly level and has an annual rainfall of 922 mm. Samples of drainage water were collected weekly for 2 yr. Water samples from the streams were analyzed for SiO2, Al2O3, Fe2O3 (total Fe), K, Na, Ca, and Mg. Elemental levels were found to be relatively constant throughout the year. The flux of elemental removal was calculated from the streamflow rate and chemical concentrations. The loss of each constituent as a result of weathering could be determined after the chemical composition was determined for the parent rock and the weathered product. Knowing the amount of an element lost and its rate of net removal from the watershed, a rate of weathering for granite was calculated as 400 kg/ha/yr for the higher rainfall area, and 150 kg/ha/yr for the lesser rainfall area. These rates can also be expressed as 15.4 and 5.8 mm of rock weathered per 1,000 yr for the two areas, to produce 11.0 and 4.1 mm of soil, respectively. Thus, slope reduction on granite in Rhodesia is 4.4 and 1.7 mm/1,000 yr for the higher and lower rainfall areas, respectively. (Humphreys-ISWS)
W79-08269

HYDROLOGIC DATA FOR WATER-TABLE AQUIFERS IN THE GREATER DENVER AREA, FRONT RANGE URBAN CORRIDOR, COLORADO,
Geological Survey, Lakewood, CO. Water Resources Div.
For primary bibliographic entry see Field 2A.
W79-08394

NITROGEN POOLS AND FLUXES IN A GEORGIA SALT MARSH,
Georgia Univ., Sapelo Island. Marine Inst.
For primary bibliographic entry see Field 2G.
W79-08477

THE EFFECT OF REEDS ON THE WATER CHEMISTRY OF GNADENSEE (BODENSEE),
Baden-Wuerttemberg Landesstelle fuer Gewaesserkunde und Wasserwirtschaftliche Planug, Karlsruhe (Germany, F.R.).
M. W. Banoub.
Archiv fur Hydrobiologie, Vol. 75, No. 4, p 500-521, July, 1975. 8 fig, 3 tab, 20 ref.

Descriptors: *Water chemistry, *Wetlands, *Aquatic plants, *Reed communities, Alkalinity, Conductivity, Nitrogen, Phosphorus.

The chemistry of water among the reed communities in Gnadensee was compared with that of the outer open water. Gradients of increasing Ca, alkalinity, conductivity, total-P, NH sub 4, COD and uv-absorption, or decreasing pH, NO sub 3 and NO sub 2 are met with as one penetrated deeper into the reeds. The shallow water among the reeds exhibited an appreciable stratification due to released material from its mud. Water exchanges between the reed zone and the lake lead to parallel seasonal variations of chemicals in both areas, however a difference in period and magnitude of variation can be traced to the effect of reeds and its mud. The major processes that occurred among the reeds are the decomposition of dead plants and the effect of the latter on the release of materials from the mud. Indication of the loss of mineral nitrogen from the water system among the reeds is attributed to denitrification and release of nitrogen as gas. Based on phosphorus balance, a residence time of water among the reeds averages to 0.9 days. The average standing stocks of material leached from the reeds during submersion constitute less than 1 percent of the theoretical input from both reeds and mud if no allowance is made for water movements. (Hinkel-Mass)
W79-08486

2L. Estuaries

CURRENT-INDUCED SEDIMENT MOVEMENT IN THE DEEP FLORIDA STRAITS: CRITICAL PARAMETERS,
Rhode Island Univ., Kingston. Graduate School of Oceanography.
M. Wimbush, and B. Lesht.
Journal of Geophysical Research, Vol. 84, No. C5, p 2495-2502, May 20, 1979. 7 fig, 2 tab, 20 ref. ONR N00014-76-C-0226.

Descriptors: *Currents(Water), *Ocean currents, *Bottom sediments, *Ripple marks, Sands, Sand waves, Photography, Current meters, Sediments, Sediment transport, On-site investigations, Oceans, Oceanography, *Florida Straits.

A time-lapse movie of the seabed at 710 m in the Florida Straits showed an irregular sequence of sediment ripple migration and suspension events, occupying 17% of the 43-day duration of the record. Sediment in the region was a moderately sorted carbonate medium sand. Simultaneous current meter records at various positions in and above the benthic boundary layer were compared in various ways with the movie record to develop reliable predictive criteria for sediment motions in situ. With initiation and termination of sediment ripple migration predicted to occur when mean current at 3-m elevation is 24 and 22 cm/s, respectively, 96% of the record was correctly predicted. (Sims-ISWS)
W79-08095

THE ASYMPTOTIC DISTRIBUTION OF THE MAXIMUM DEFICIT OF PARTIAL SUMS OF INDEPENDENT RANDOM VARIABLES,
Colorado State Univ., Fort Collins.
F. L. S. Gomide.
Water Resources Research, Vol. 15, No. 2, p 495-497, April 1979. 3 tab, 1 ref. NSF GK-31512X.

Descriptors: *Reservoirs, *Storage capacity, *Model studies, Mathematical models, Markov processes, Theoretical analysis, Mathematics, Statistics, Statistical models, Asymptotic distribution, Random variables.

Studies of storage capacity of reservoirs lead to the problem of finding the distribution of the maximum deficit of partial sums of independent random variables. In this paper, the asymptotic distribution of the maximum deficit was derived using the theory of Markov chains. The range and the adjusted range of partial sums of independent random variables were also discussed. (Sims-ISWS)
W79-08096

FINITE ELEMENT SIMULATION OF WATER CIRCULATION IN THE NORTH SEA,
Southampton Univ. (England). Dept. of Civil Engineering.
C. A. Brebbia, and P. W. Partridge.
Applied Mathematical Modelling, Vol. 1, No. 2, p 101-107, September 1976. 8 fig, 19 equ, 9 ref.

Descriptors: *Finite element analysis, *Simulation analysis, *Water circulation, *North Sea, *Tidal effects, *Storm surge, *Currents, Shallow water, Equations, Mathematical models, Time integration, Friction level, Chezy's coefficient, Systems analysis.

The modelling of tidal effects, storm surges and currents in large bodies of water is considered. The solution is attempted using the evolutionary shallow water equations with velocities and wave heights as unknowns. Two finite element simulation models are described based on six noded triangular elements. Special consideration has been given to the adequacy of the models which were applied to the North Sea only after extensive tests in channels. Results for velocities and wave heights are compared and discussed. A set of conclusions on the applicability and scope of the models is presented. (Bell-Graf-Cornell)
W79-08209

ON THE EFFECT OF PRECIPITATION AND RUNOFF ON COASTAL CIRCULATION IN THE GULF OF ALASKA,
Alaska Univ., Fairbanks. Inst. of Marine Science.
T. C. Royer.
Journal of Physical Oceanography, Vol. 9, No. 3, p 555-563, May 1979. 7 fig, 2 tab, 20 ref. NOAA 03-5-022-56, NSF OCE75-23187.

Descriptors: *Precipitation(Atmospheric), *Runoff, *Ocean circulation, *Coasts, *Alaska, Rainfall, Snowmelt, Streamflow, Rivers, Mountains, Oceans, Gulfs, Circulation, Water circulation, Density, Winds, Wind pressure, Temperature, Hydrology, Oceanography, *Gulf of Alaska.

Surface waters in the Gulf of Alaska undergo a net dilution throughout most of the year since the regional precipitation exceeds evaporation. Recent hydrographic data give evidence that seasonal dynamic height fluctuations in the upper layers (less than 100 m) are well-correlated with the seasonal changes in precipitation and runoff. The precipitation effect is magnified by coastal mountain ranges which enhance the rainfall at or near the coast, contributing freshwater at the coast through runoff. Previous estimates of the offshore precipitation gradient appear to be smaller than those measured recently. Precipitation and runoff alter the dynamic height through salinity changes. This dependence of dynamic height on salinity is possible here because of the high precipitation (more than 130 cm/year), runoff, longshore accumulation of freshwater around the gyre, and the low water temperatures. The coastal sea level is in phase and has nearly the same amplitude as the local dynamic height, though not in phase with heating and cooling. Both the seasonal cycles of sea level and precipitation and their anomalies are well-correlated. The majority of the seasonal sea level variations can be accounted for by the local steric property changes. The small difference between the dynamic height and sea level implies that the barotropic effects on sea level are small. The dynamic height and longshore flow respond to the annual hydrologic cycle for the Alaska south coast area. This provides an important mechanism through which the atmosphere can affect the local ocean circulation. The dynamic height beneath 100 m responds to wind stress changes through Ekman pumping and coastal divergences and convergences. Thus precipitation, runoff, and wind stress are all important to the coastal dynamics here. (Sims-ISWS)
W79-08237

SETTLING BEHAVIOR OF NATURAL AQUATIC PARTICULATES,
Chicago Univ., IL. Dept. of Geophysical Sciences.
For primary bibliographic entry see Field 2J.
W79-08238

ARSENIC SPECIATION IN SEAWATER AND INTERSTITIAL WATERS: THE INFLUENCE OF BIOLOGICAL-CHEMICAL INTERACTIONS ON THE CHEMISTRY OF A TRACE ELEMENT,
Scripps Institution of Oceanography, La Jolla, CA.
For primary bibliographic entry see Field 2K.
W79-08240

BIOLOGICAL PRODUCTION AND THE EXCHANGE OF OXYGEN AND CARBON DIOXIDE ACROSS THE SEA SURFACE IN STUART CHANNEL, BRITISH COLUMBIA,
Oregon State Univ., Corvallis. School of Oceanography.
For primary bibliographic entry see Field 2K.
W79-08241

ORGANIC DETRITUS PARTICLES: INITIATION OF MOTION CRITERIA,
Clemson Univ., SC. Dept. of Civil Engineering.
For primary bibliographic entry see Field 2J.
W79-08243

ON THE MEAN CIRCULATION IN THE MID-ATLANTIC BIGHT,
Woods Hole Oceanographic Institution, MA.
R. C. Beardsley, and C. D. Winant.
Journal of Physical Oceanography, Vol. 9, No. 3, p 612-619, May 1979. 4 fig, 1 tab, 19 ref. NSF OCE 76-01813, OCE76-19494.

Descriptors: *Circulation, *Ocean circulation, *Atlantic Ocean, Oceans, Coasts, Winds, Wind pressure, Runoff, Salinity, Density, Model studies, Mathematical models, Computer models, Continental shelf, Water circulation, Currents(Water), Ocean currents, Oceanography, *Mid-Atlantic Bight.

Two possible mechanisms which may drive the observed mean alongshelf flow in the Mid-Atlantic Bight were described. Runoff from concentrated sources could conceivably force this flow; however, the one-layer homogeneous model results of Csanady, and Beardsley and Hart imply that the observed shelf flow is not driven by runoff alone. On the other hand, the Semtner and Mintz numerical model of the North Atlantic strongly suggests that the shelf circulation is just a boundary layer component of the ocean circulation and thus driven by the large-scale wind stress and heat flux distributions. This model result supports Csanady's conclusion that the physical mechanism which creates the alongshelf pressure gradient thought to drive the alongshelf flow must be of oceanic origin. (Sims-ISWS)
W79-08255

STRESS AND TIDAL CURRENT IN A WELL-MIXED ESTUARY,
New Hampshire Univ., Durham. Dept. of Mechanical Engineering.
M. R. Swift, R. Reichard, and B. Celikkol.
Journal of the Hydraulics Division, American Society of Civil Engineers, Vol. 105, No. HY7, Proceedings Paper 14682, p 785-799, July 1979. 5 fig, 1 tab, 9 ref, 3 append.

Descriptors: *Estuaries, *Tidal waters, *Currents(Water), *Stress, Model studies, Mathematical models, On-site investigations, Shear stress, Turbulence, Channels, Tides, Flow, Boundary layers, Reynolds number, Friction, Fluid friction, Hydraulics, Hydrodynamics, Oceanography, *Well-mixed estuaries.

A procedure for calculating the vertical shear stress distribution in tidal channels of well-mixed estuaries from current profile measurements was formulated. A linearized boundary layer form of the Navier-Stokes equation and eddy viscosity representation of Reynolds shear stress were used to determine the depth and time dependence of current velocity and stress. A lower (near bottom) boundary condition on stress was employed rather than the usual no-slip condition on velocity. A verification experiment was described in which the theoretical model was used to calculate stress from current profile data taken in a tidal channel over a half tidal cycle. The predicted stress was then compared with a direct independent measurement of Reynolds shear stress. It was shown that for a one-layer estuary model, best results are obtained using an eddy viscosity having a quadratic depth dependence. (Sims-ISWS)
W79-08261

STUDIES ON THE SEDIMENT OF ST. MARGARET'S BAY, NOVA SCOTIA,
Bedford Inst. of Oceanography, Dartmouth (Nova Scotia). Marine Ecology Lab.
T. G. Hughes.
Journal of the Fisheries Research Board of Canada, Vol. 36, No. 5, p 529-536, May 1979. 5 fig, 2 tab, 25 ref.

Descriptors: *Bays, *Sediments, *Organic matter, *On-site investigations, *Canada, Particle size, Sampling, Testing procedures, Methodology, Analytical techniques, Cores, Mineralogy, Gravimetric techniques, Measurement, Distribution, *Nova Scotia, *St. Margaret's Bay(Nova Scotia), Organic carbon, Total organic carbon.

A detailed examination of the sediment in a small area of St. Margaret's Bay revealed it to be com-

posed of two main types of particles, mineral particles and particles of organic debris. Debris was also adsorbed onto the mineral particles. Particles generally had relatively low numbers of bacteria associated with them, indicating that most of the organic carbon in the sediment is refractory. Variation in size distribution of the component particles with depth in the sediment was found to be minimal, but a slight decrease in the proportion of debris particles was seen. Variation in size distribution along a transect was also limited, but where the mineral particles became coarser, the size range of the debris particles remained constant. The relative amount of debris particles along the transect varied little, but values for total organic carbon (by weight) changed dramatically. (Humphreys-ISWS)
W79-08267

PUGET SOUND CIRCULATION: FINAL REPORT FOR FY77-78,
National Oceanic and Atmospheric Administration, Seattle, WA. Pacific Marine Environmental Lab.
G. A. Cannon, N. P. Laird, and T. L. Keefer.
NOAA Technical Memorandum ERL MESA-40, February 1979. 60 p, 29 fig, 3 tab, 16 ref.

Descriptors: *Circulation, *Estuaries, Effluents, Water properties, Waste water disposal, Washington, *Puget Sound(WA), Estuarine circulation, Marine Ecosystems Analysis Program(MESA).

Physical oceanographic research in Puget Sound has focused on describing deep water flow through the main basin and on determining its principal driving mechanisms. Observations, however, have been made throughout the water column using moored current meters and shipboard STD surveys. The main experimental site has been located near the largest single wastewater discharge point in Puget Sound. Hence, some of the results should be applicable in determining physical factors influencing the transport and dispersions of effluents. Additional observations were made in 1977 in The Narrows and in Admiralty Inlet, the two major sills located at opposite ends of the main basin. Observations during winter near The Narrows and Vashon Island confirmed earlier hydraulic model data and showed a clockwise tidally averaged flow around Vashon Island. Observations during late summer to early fall in Admiralty Inlet showed new bottom water entering Puget Sound both when flood tides ranges did and did not exceed 3.5 m. (NOAA)
W79-08380

3. WATER SUPPLY AUGMENTATION AND CONSERVATION

3A. Saline Water Conversion

DESALINATION APPARATUS,
K. F. Ziehm, Jr.
U.S. Patent No. 4,138,293, 6 p, 7 fig, 8 ref; Official Gazette of the United States Patent Office, Vol. 979, No. 1, p 249, February 6, 1979.

Descriptors: *Patents, *Desalination, *Desalination process, *Desalination apparatus, Separation techniques, Water purification, Solar radiation, Water vapor, Condensation.

Solar heat-absorbing metal members such as balls, rollers or a metal endless belt is utilized to initially absorb solar heat in a heating chamber. The metal members pass beneath a transparent cover and become heated through absorption of the solar radiation passing through the cover. These metal members with their latent heat then pass directly into a vaporizing chamber where they are sprayed with sea water or other salt or saline water. The latent heat causes essentially salt-free water to vaporize. The vapors are condensed by a condenser system such as condenser tubes through which pass cooler raw sea water or other readily available water. The condensed vapors are collected, thereby providing substantially pure water. After the metal members pass through the vaporizing chamber they are encrusted with the salts of the sea water and are immediately rinsed in a rinse tank which is supplied with warm rinse water coming from the condenser tubing. After such rinsing they are returned to the heating chamber for solar reheating and a repetition of the vaporizing and rinsing functions. (Sinha-OEIS)
W79-08227

FLOW CONTROL ALGORITHMS FOR YUMA DESALTING PLANT,
Bureau of Reclamation, Denver, CO. Electric Power Branch.
For primary bibliographic entry see Field 8C.
W79-08356

STATUS OF THE YUMA DESALTING PLANT,
Bureau of Reclamation, Denver, CO. Denver Federal Center.
L. A. Haugseth.
Desalination, Vol. 27, No. 3, p 157-174, Dec., 1978, 6 fig, 1 tab, 3 ref.

Descriptors: *Desalination, *Water treatment, *Desalination apparatus, *Desalination plants, Saline water systems, Treatment facilities, Colorado River, Mexican water treaty, Yuma desalting plant.

The current status of the Yuma Desalting Plant, located 7.4 km west of Yuma, Arizona, in response to the U.S. agreement to provide Mexico with water of a salinity of no more than 115 p/m greater than the salinity of Colorado River water arriving at the Imperial Dam, is summarized. Progress on the 4.21 m3/s membrane desalting plant, including site selection, equipment proposals, specifications for peripheral support equipment, the sludge disposal site, and the power source are discussed. Current plans calling for as many as 20 separate contracts to cover the plant have been slowed somewhat until a legal question concerning the procurement of equipment is decided upon by the General Accounting Office although a decision is expected shortly. (Tickes-Arizona)
W79-08377

3B. Water Yield Improvement

USE OF GROUND WATER FOR THE DEVELOPMENT OF RAJASTHAN DESERT,
Malviya Regional Engineering Coll., Jaipur (India). Dept. of Civil Engineering.
R. D. Verma.
Transactions of Indian Society of Desert Technology and University Center of Desert Studies, Vol. 2, No. 2, p 145-151, Dec. 1977, 4 tab, 7 ref.

Descriptors: *Groundwater resources, *Water transfer, *Water resources development, *Planning, Water balance, Groundwater availability, Groundwater recharge, Mathematical models, Alternate planning, Comprehensive planning, Future planning(Projected), Rajasthan Desert, India, Groundwater mining.

This paper reviews the progress being made in the development of groundwater resources in the region of the Indian Desert which encompases the western half of Rajasthan and extends over parts of Gujarat and Haryana. Although a scientific assessment of the surface and groundwater resources of this desert area have yet to be completed, the Central Water Board with the assistance of the United Nations Development Programme has recently made studies for the development of groundwater resources in Rajasthan with the following results and recommendations: (1) water level observations indicate some recharge due to precipitation, (2) water balance studies of selective basins within the region should be combined with reliable methods of scientific hydrology and mathematical optimization modelling to determine available water resources and formulate plans for optimal use, (3) Long term groundwater mining for the economic development of the desert areas suggest that water utilization be restricted to various uses, and (4) new surface water sources from the Narmada, Mahi, and Ganga Rivers should be developed for transferring water from these basins to the arid areas of Rajasthan. (Tickes-Arizona)
W79-08025

WATER HARVESTING PRACTICES FOR ARID AREAS,
Punjab Agricultural Univ., Ludhiana (India). Dept. of Soils.
T. N. Chaudhary, and S. S. Prihar.
Transactions of Indian Society of Desert Technology and University Centre of Desert Studies, Vol. 2, No. 2, p 232-239, Dec 1977. 3 fig, 3 tab, 25 ref.

Descriptors: *Water harvesting, *Rainfall-runoff relationships, *Runoff, *Water spreading, Arid climates, Water conservation, Water yield improvement, Surface runoff, Reservoir storage, Water storage, Seepage, Sedimentation, Rainfall disposition, Farm ponds, Irrigation water, Soil properties.

Water harvesting or the collection of runoff water from either treated or untreated land is discussed here in two categories: (1) runoff recycling where runoff is stored in a reservoir for supplemental irrigation, and (2) runoff farming where harvested water is stored in the soil itself. Runoff recycling systems involving the inducement and storage of runoff and supplemental irrigation are dependent upon the control of seepage, evaporation and sedimentation and some of the potential measures to achieve these objectives are discussed. Runoff farming, on the other hand, involves diversion of runoff from watersheds to cropped areas and is dependent upon rainfall pattern, land configuration, soil and crop characteristics and the ratio of catchment to cropped area. The requisites, advantages, designs and selected results of runoff farming systems are described. It is concluded that since system choice and design is site specific, intensive studies are needed to determine suitable techniques for different areas. (Tickes-Arizona)
W79-08032

PROSPECTS OF WATER HARVESTING AND ITS UTILIZATION IN SAND DUNE AREAS OF SOUTH-WEST HARYANA,
Haryana Agricultural Univ., Hissar (India). Dept. of Soils.
R. P. Agarwal, M. C. Agarwal, K. Singh, and J. Nath.
Transactions of Indian Society of Desert Technology and University Centre of Desert Studies, Vol. 2, No. 2, p 255-261, Dec 1977. 6 tab, 1 fig, 9 ref.

Descriptors: *Water harvesting, *Rainfall-runoff relationships, *Runoff, *Sands, *Dunes, Arid climates, Water conservation, Water yield improvement, Water storage, Soil moisture, Groundwater, Agricultural production, Rainfall disposition, Infiltration, Desalination, India.

The prospects of water harvesting techniques for the semiarid sand dune regions of Southwest Haryana, India, are discussed. Although water harvesting techniques involving both the storage of water in the soil and runoff recycling have limited applicability in sand dune areas, an approach is suggested here for the utilization of water harvested as surplus groundwater to stabilize agricultural production in these areas. An analysis of the rainfall and soil characteristics of this region indicate that high infiltration, low moisture storage capacity, high evaporative demand and lack of intense rain showers to cause runoff make it necessary to seek additional means of supplying agricultural water to these deficient areas. Suggested techniques include the utilization of presently under-exploited groundwater resources, desalination, and more judicious use of soil water. (Tickes-Arizona)
W79-08033

NUMERICAL MODELLING OF ICEBERG TOWING FOR WATER SUPPLIES--A CASE STUDY,
Adelaide Univ. (Australia). Dept. of Chemical Engineering.
For primary bibliographic entry see Field 2C.
W79-08120

WEATHER MODIFICATION ACTIVITIES IN NORTH DAKOTA, SOUTH DAKOTA, AND MINNESOTA FROM 1951 THROUGH 1976,
North Dakota Univ., Grand Forks.
M. R. Schock.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-275 669, Price codes: A07 in paper copy, A01 in microfiche. Report No. UND 77-4, September 1977. 125 p, 26 fig, 26 tab, 124 ref, 1 append. 14-06-D-7581.

Descriptors: *Weather modification, *Cloud seeding, *Evaluation, History, Benefits, Technology, Statistics, Environmental effects, Feasibility, State governments, Local governments, North Dakota, South Dakota, Minnesota.

The impacts of the weather modification projects taking place over North Dakota, South Dakota, and Minnesota are assessed to provide information for the evaluation of future weather modification research and applied projects. This two-part study focuses on the administrative and technical designs of projects conducted from 1951 through 1976. Part 1 is an historical overview in which delivery techniques, environmental assessments, the feasibility of achieving benefits, project documentation, evaluation methods, decision processes and factors, and the roles of state and local governments in weather modification are discussed. The appendix to Part 1 contains a list of significant historical dates in weather modification. Selected available information about each project provided in Part 2 includes: the project operator, the project name or sponsor, the project operational period, the target area, project objective, seeding technique, and available references. (Davison-IPA)
W79-08153

1978 STATUS REPORT -- THE SIERRA COOPERATIVE PILOT PROJECT, PRECIPITATION MANAGEMENT RESEARCH IN THE SIERRA NEVADA,
Bureau of Reclamation, Denver, CO. Office of Atmospheric Resources Management.
E. R. Harris.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-282 430, Price codes: A04 in paper copy, A01 in microfiche. Status Report, April 1978. 70 p, 6 fig, 5 tab.

Descriptors: *Weather modification, *Cloud seeding, *Social aspects, *Artificial precipitation, Environmental effects, Social impact, Evaluation, Project planning, Project feasibility, Water management(Applied), Cloud physics, Sierra Cooperative Pilot Project, Project Skywater, Sierra Nevada, American River Basin.

The activities and cooperative efforts of Project Skywater personnel and contractors, Federal, State regional and local agencies, private sector organizations, and residents of the study area are reported to provide up-to-date information on the progress of the Sierra Cooperative Pilot Project (SCPP). The technical feasibility and social acceptability of precipitation enhancement as an alternative water resource management tool are discussed; Results of the 1976-77 winter study season and the 1977-78 season activities are discussed; future activity is previewed. In early 1976 a liquid-tank model using stratified liquid was designed to simulate wind patterns across the eastern side of the Sacramento Valley, over the Sierra Nevada, and on into Western Nevada. The model was used to study the manner in which seeding material moves under three different atmospheric conditions: a prestorm situation with a deep inversion in the atmosphere, during a storm situation, and a post-storm situation. Other activities of the 1976-77 season include: tracer and diffusion and cloud microphysical studies in the American River Basin, development of radar climatology for the Sierra Nevada, acoustic sounder observations, ground microphysics, a precipitation profile for the area from Sacramento to Truckee, California, and satellite observations and data collection. The project field office was established at Auburn. (Davison-IPA)
W79-08350

FINAL REPORT SIERRA COOPERATIVE PILOT PROJECT,
Aero Systems, Inc., Boulder, CO.
W. J. Carley, F. S. Solheim, E. X. Berry, and L. E. Liles.
Report prepared for Bureau of Reclamation, Denver, Colorado May 31, 1979. 82 p, 2 fig, 2 tab, 3 append.

Descriptors: *Cloud seeding, *Dry ice, Silver iodide, *Sierra Nevada Mountains, Snow management, Weather modification, Ice, Data storage and retrieval, Artificial precipitation, Rain, Chemistry of precipitation, Clouds, Cloud physics.

The performance of Aero Systems, Incorporated in the 1978-79 Sierra Cooperative Pilot Project (SCPP) is examined. The company provided an aircraft capable of seeding with dry ice and silver iodide flares and of measuring basic cloud physics parameters related to determining a cloud's seedability. Software was developed allowing data to be reduced on the University of Wyoming computer for review immediately after flight. Aero Systems also performed reduction and preliminary analysis of the seeder aircraft's airborne data. Key accomplishments under the contract were: excellent performance of aircraft and flight crew, encouraging and adopting the use of a short period randomization scheme to dramatically reduce learning time over the original scheduled randomizations, and the accurate targeting and locating of the seeded plumes to assist various cloud physics measurements of seeding effect. Observations and review of data tentatively suggest that cost effective operational cloud seeding may not be possible in the northern Sierra Nevada. (Schaefer-IPA)
W79-08358

WILLAMETTE BASIN COMPREHENSIVE STUDY OF WATER AND RELATED LAND RESOURCES: APPENDIX F -- IRRIGATION.
Pacific Nothwest River Basins Commission, Portland, OR. Willamette Basin Task Force.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A036 758, Price codes: A08 in paper copy, A01 in microfiche. Chaired by the Bureau of Reclamation, 1969, 97 p, 53 tab, 5 fig, 25 maps, 20 photos.

Descriptors: *Water resources, *Water resources development, *Irrigation, *River basin development, *Water distribution(Applied), *Water sources, *Water demand, Oregon, Water law, Planning, Land use, Land resources, Irrigable land, Arable land, Land reclamation, Land classification, Water requirements, Water rights, Irrigated land, Irrigation effects, Irrigation practices, Irrigation programs, Irrigation water, Irrigation systems, Irrigation efficiency, Groundwater, Multipurpose projects, River basins, *Willamette River(OR).

This study was undertaken to plan for the proper development of water and related land resources in the Willamette River Basin in Oregon. Appendix F - one of the functional appendices - relies upon supporting data contained in the 3 supporting appendices, A through C. Its objectives are to appraise present irrigation development, to outline irrigation potential, and to recommend irrigation development. Projections are given for the years 1980, 2000, and 2020. The present status of irrigation in the Basin is first reviewed by looking at present irrigation development through irrigated land, water sources, quality, rights and use, and the irrigation economy. Irrigation potential is assessed through land characteristics; problems are outlined. Future demands are projected using a study of the irrigation economy-farm types, crop yields, land use, livestock, and markets. Alternative means of satisfying demands are first outlined on a basin-wide scale and then presented for each of 11 subbasins. Since seasonal distribution of rainfall is a serious deterrent to optimum agricultural production, it is felt that further irrigation development is vital. This development is expected to increase in the next three decades and then to level off. Use of groundwater is projected, along with the development of new storage facilities. Consideration of redistributing present storage assignment is also suggested. A final recommendation calls for the strengthening and facilitation of enforcement of the state's water rights program. (See also W79-08433) (Zayac-NC)
W79-08439

WILLAMETTE BASIN COMPREHENSIVE STUDY OF WATER AND RELATED LAND RESOURCES: APPENDIX H--MUNICIPAL AND INDUSTRIAL WATER SUPPLY.
Pacific Northwest River Basins Commission, Portland, OR. Willamette Basin Task Force.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A036 760, Price codes: A05 in paper copy, A01 in microfiche. Chaired by Federal Water Pollution Control Administration, 1969, 13 tab, 9 fig, 2 maps, 15 photos, 78 p.

Descriptors: *Water supply, *River basin development, *Water demand, *Water resources development, *Water supply development, *Water use, Oregon, Dependable supply, Groundwater resources, Hydrology, Low-flow augmentation, Potential water supply, Pumped storage, Reservoir operation, Storage requirements, Surface water availability, Water allocation(Policy), Water conservation, Water conveyance, Water delivery, Water costs, Water policy, Water requirements, *Water resources, Water sources, Watershed management, River basins, Planning, *Willamette River(OR).

This study was undertaken to plan for the proper development of water and related land resources of the Willamette River Basin in Oregon. Appendix H - one of the functional appendices - is based on data contained in the 3 supporting appendices, A through C. Its scope limits projection of municipal and industrial water supply requirements to the years 1980, 2000, and 2020. Appraisal of the 1980 requirements includes consideration of quantity, quality, and seasonal variation of supply and demand; the needs identified are more immediate in nature and may be related to the development of a comprehensive plan for foreseeable developments. The long-range plans point toward the needs of the 11 major subareas of the basin. In assessing the basin's present status of water supply, water use, water quality, and water sources are studied. Water use is discussed through water service for each subbasin, seasonal distribution of demand and per capita use; water quantity is reviewed by looking at water treatment and the cost of water. A section on future demands looks at water use trends and projections and specific problems in storage reservations, source identification, watershed management, and growth of demand. Alternatives are presented and reviewed for each subbasin. The study concludes that, broadly construed, there will continue to be excess of total supplies over demand. However, problems may arise both in specific areas and due to changing social and technological conditions. Thus, the recommendations are that present-day policies and attitudes be reevaluated if available resources are to be used efficiently. Among those policies are the ones involved with development and conveyance of water supplies from mountain sources and the planning for combining and centralizing municipal supply systems. (See also W79-08433) (Zayac-NC)
W79-08441

3C. Use Of Water Of Impaired Quality

RECYCLING OF SEWAGE EFFLUENT BY SUGARCANE IRRIGATION: A POSTTREATMENT STUDY JULY 1977 TO JUNE 1978 PHASE II-B (PROGRESS REPORT),
Hawaii Univ., Honolulu. Water Resources Research Center.
L. S. Lau, R. H. F. Young, P. C. Loh, V. F. Bralts, and E. K. F. Liu.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-298 014. Price codes: A04 in paper copy, A01 in microfiche. Technical Report No. 121, October 1978. 59 p, 12 fig, 2 plates, 7 tab, 30 ref, 5 append.

Descriptors: *Waste water treatment, *Water reuse, Screening, Filtration, Chlorination, Activated sludge, Sugarcane, Hawaii, *Drip irrigation, Posttreatment, Mililani STP, Oahu.

A pilot tube farm has been installed at the Mililani Sewage Treatment Plant, O'ahu, Hawai'i, to study the necessary treatment of activated sludge effluent for drip irrigation. Four types of effluent will be processed: 100% effluent, 50% effluent diluted with 50% Waiahole Ditch water plus the 100% effluent and the 50% to 50% mix after a 3-day detention in reservoir storage. Efficacy of treatment will be determined by the rate of plugging of the holes in the drip irrigation tubes and the quality of the posttreated water. The present posttreatment system consists of two-stage pressure filtration: first through No. 3 anthracite, then through No. 11 crushed granite. Filtration rate is 0.001 36-0.002 7 m3/s/m2 (2-4 gpm/ft2). The filtrate is given chemical treatment by chlorine, bromine chloride, or chlorine dioxide at a dosage equivalent to a 10 mg/l chlorine residual at the end of the drip tube line. The system and the dosages will be varied to a level that will yield least plugging. Both single-chamber and dual-chamber tubing will be tested. The tube farm is automated and is operated on a 24-hr day schedule, processing 100% effluent for 12 hr and 50 to 50% dilution for 12 hr. Backwash takes place as the end of the run. Mean values for the effluent and ditch water were respectively, suspended solids, 31 and 23 mg/l; total plate count, 3 and 30 organisms x 1000/ml; total coliform, 34 and 970 organisms/ml; and total organic carbon, 56 and 27 mg/l. The volatile suspended solids content was 90% for the effluent but only 30% for the ditch water. A reuse bibliography has been compiled. A hydraulics test stand facility has been developed to study the effects of plugging on the hydraulics of emitter flow in drip irrigation lateral lines.
W79-08198

SALT WATER FIRE FIGHTING SUPPLY NORMALLY EXCLUDING SALT WATER,
Phillips Petroleum Co., Bartlesville, OK. (Assignee).
E. E. Slanker.
U.S. Patent No. 4,140,146, 4 p, 1 fig, 1 ref; Official Gazette of the United States Patent Office, Vol 979, No. 3, p 873, February 20, 1979.

Descriptors: *Patents, *Seawater, Saline water, Impaired water use, Impaired water quality, Water tanks, Water supply, Firefighting.

The object of this invention is to provide a fire water system normally filled with fresh water to avoid corrosion due to salt water, and a switch-cover to a seawater or salt water supply will take place automatically while there is still in the system a plentiful supply of fresh water. A fresh-water tank or sump is positioned with respect to a salt water or seawater supply in a manner such that the level of fresh water is substantially higher than the highest expected level of the salt water. A salt water supply pipe is connected into the fresh water tank at a point well below the normal level of fresh water in the tank but at a point above the suction of at least one pump adapted to pump water for fighting fire. The seawater supply pipe is equipped with a flap or equivalent valve which is maintained closed by the hydrostatic head of the fresh water which is higher than that of the salt water at the flap valve. (Sinha-OEIS)
W79-08234

ENERGY AND WATER SUPPLY, ORANGE COUNTY, CALIFORNIA,
Orange County Water District, Fountain Valley, CA.
D. G. Argo.
Desalination, Vol. 25, No. 2, p 135-149, April 1978. 2 tab, 2 fig, 5 ref.

Descriptors: *Water conveyance, Hydrologic budget, *Energy budget, *Water reuse, *Water allocation(Policy), *Water distribution(Applied), Conveyance structures, Engineering structures, Hydraulic structures, Colorado River, Energy gradient, Planning, Water supply, Water management(Applied), California.

In the arid southwest, where water is transferred great distances from areas of surplus to areas of shortage, the availability of power to move water is as vital as the water itself. In California and particularly Southern California, the demand for water has exceeded the local supply almost from the beginning of the settlement of the land and water leaders have devised some of the most elaborate water conveyance systems in the world. The purpose of the present paper is to evaluate the energy requirements of all water sources available to the service area of the Orange County Water District in Southern California where 1.5 million people rely upon a complex water supply system composed of local groundwater and imported water from the Colorado River and from Northern California. The summary of the actual energy costs to deliver and supply Orange County with water from three alternative sources: The Colorado River, water factory 21, and the state water project indicates that wastewater management reclamation appears to hold the greatest promise. (Tickes-Arizona)
W79-08376

3E. Conservation In Industry

METHOD FOR DECONTAMINATING WASTE MATERIAL FROM CHROMIUM MINERAL PROCESSING BY WET TREATMENT WITH SULPHUR,
Stappani (Luigi) di Stappani (P.) and Co., Milan (Italy). (Assignee).
For primary bibliographic entry see Field 5D.
W79-08214

3F. Conservation In Agriculture

UTILIZATION OF A PORTABLE SOLID STATE FURROW IRRIGATION VALVE CONTROLLER,
Nebraska Univ. Panhandle Station at Scottsbluff.
R. J. Edling, H. R. Duke, and M. L. Payne.
Paper No. 78-2546, Presented at the 1978 Winter Meeting of the American Society of Agricultural Engineers, December 18-20, 1978, Chicago, Illinois, 13 p. 3 fig, 4 ref. ASAE, St. Joseph, Michigan.

Descriptors: *Furrow irrigation, Valves, *Control systems, Automation, Instrumentation, Application equipment, Electronic equipment, Irrigation systems.

Research was conducted during the summers of 1977-1978 on an USDA-SEA controller to allow semi-automatic changing of furrow irrigation sets. Two types of control valves were used with the controller. After initial difficulties, satisfactory use was obtained with the controller and both types of valves. Additional work in an on-farm situation was advised before the controllers use is recommended. (Skogerboe-Colorado State)
W79-08001

VOLUMETRIC CONTROL FOR IRRIGATION AUTOMATION,
Science and Education Administration, Fort Collins, CO.
H. R. Duke, M. L. Payne, and D. C. Kincaid.
Paper No. 78-2545, Presented at the 1978 Winter Meeting of the American Society of Agricultural Engineers, December 18-20, Chicago, Illinois, 8 p. 3 fig, 4 ref. ASAE, St. Joseph, Michigan.

Descriptors: *Surface irrigation, Automatic control, *Control systems, Automation, Electronic equipment, Instrumentation, Irrigation programs, Irrigation systems.

A digital electronic controller was developed for use in surface irrigation automation. This controller has full random-multiplexing capabilities and is capable of integrating flow rates as measured through a nonlinear open channel flow measurement device. (Skogerboe-Colorado State)
W79-08004

RESPONSE OF CORN TO LIMITED IRRIGATION ON SANDY SOILS,
Nebraska Univ., North Platte. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 2I.
W79-08008

EXPLICIT SPRINKLER IRRIGATION UNIFORMITY: EFFICIENCY MODEL,
Colorado State Univ., Fort Collins. Dept. of Agricultural and Chemical Engineering.
W. R. Walker.
Journal of the Irrigation and Drainage Division, Proceedings of the American Society of Civil Engineers, Vol. 105, No. IR2, p 129-136, June 1979. 5 fig, 8 ref.

Descriptors: *Irrigation efficiency, *Sprinkler irrigation, *Application methods, Mathematical models, Systems analysis, Equations, Evaluation, Performance, Yield reductions, Economics, Pattern uniformity, Soil moisture depletion.

The relationship between pattern uniformity and application efficiency under a sprinkler irrigation system in which the pattern is assumed to be normally distributed over an area of uniform soil moisture depletion is expressed mathematically. Empirical equations relating the pattern's coefficient of variation, the fraction of adequately irrigated area, and the ratio of the mean required depth are summarized. The mathematical model is an aid in evaluating the performance of a sprinkler irrigation system on the basis of potential yield reductions over inadequately watered areas, the economic trade-off between the system's water application uniformity and its cost, and the environmental impacts of excessive drainage. Given criteria for assessing a sprinkler irrigation system in the general sense, the model allows design and operation optimization under widely differing conditions. (Bell Graf-Cornell)
W79-08012

JOJOBA WATER-HARVESTING AGRISYSTEM EXPERIMENT, PAPAGO INDIAN RESERVATION, SELLS, ARIZONA,
Arizona Water Resources Research Center, Tucson.
C. B. Cluff.
Jojoba Happenings, No. 24, p 3-10, September 1978, 3 fig, 2 tab, 9 ref.

Descriptors: *Water harvesting, *Water yield improvement, *Surface sealing, *Crop response, Rainfall-runoff relationships, Water conservation, Asphalt, Paraffin wax, Sodium chloride, Jojoba, Agricultural production, Economic justification, Water storage, Detention reservoirs, Sealants.

Described here is an agrisystem established at Sells, Arizona, in 1974-75, to demonstrate how water harvesting techniques can be used to concentrate precipitation and enhance the growth and production of Jojoba. Three catchments treatments: (1) sodium chloride, (2) asphalt-plastic-asphalt chip (APAC), and (3) paraffin wax were applied to three 60 by 270 foot areas containing two 30 foot wide drainage catchments with a row of Jojoba plants in the center. Catchments which were constructed on a 10% slope, drain into three reservoirs to facilitate water storage and pump back irrigation during winter and spring to maximize bean production. Results have indicated that the salt treated catchments which effectively shed water and control weeds on the catchment slopes are good for raising jojoba while the APAC-treated catchments weathered well except in areas where the initial chip treatment was inadequate and in localized areas where runoff has eroded the chip cover. The wax treatment does not seem to be long lasting and little usual evidence remains of surviving wax after three years. A summary of these results together with a review of the growing economic potential of jojoba indicates that larger installations of Jojoba water-harvesting agrisystems are justified. (Tickes-Arizona)
W79-08014

GROWING OF PROCESSING-TOMATO PLANTS UNDER WATER-DEFICIENCY CONDITIONS: MULCHING WITH TRANSPARENT POLYETHYLENE.

Hebrew Univ., Rehovot (Israel). Faculty of Agriculture.
J. Rudich.
Scientia Horticulturae, Vol. 10, p 117-125, 1979. 5 tab, 12 ref.

Descriptors: *Consumptive use, *Tomatoes, *Crop response, *Soil-water-plant relationships, *Water requirements, *Soil moisture, Soil management, Soil treatment, Agronomy, Water utilization, Crop production, Moisture uptake, Mulching, Soil surfaces, Fertilization, Dryfarming, Agricultural production, Chemical composition, Plastics, Varieties.

Agricultural production in water-stressed arid regions is based on the ability to find the optimal way for the plant to utilize the limited water reserves accumulated in the soil. Summarized here are the results of 6 years of research conducted in the semiarid northern region of Israel to determine the optimal cultivars, population size, distance between rows, phosphorus fertilization, seeding time, and mulching materials for the production of tomatoes under dry-farming conditions. Data are presented from the last 2 years of experimentation which processing tomatoes (Lycopersicon esculentum Mill.) were cultivated without irrigation in ar area devoid of summer precipitation by a method which included mulching with transparent polyethylene and intensified phosphorus fertilization. A factorial experiment was designed consisting of 6 10M long by 1.3M wide randomized block replicats in which mulching was done with transparent polyethylene sheets of .03MM thickness, fertilization carried out by the split plot method, and fruit harvested in a single operation. With emphasis placed upon the soil mulching effects and the interaction of mulching with other agrotechnical practices within the growers' control, results indicated that under the dry cultivation methods tested fruit quality was superior with respect to total soluble solids (TSS 7-8 degrees BRIX) high acidity amounting to 0.5% total titrated acid and high viscosity. (Tickes-Arizona)
W79-08021

UTILIZATION OF DRIP IRRIGATION FOR DESERT CONDITIONS,
University of Agricultural Sciences, Bangalore (India). Dept. of Agricultural Engineering.
T. C. Channappa.
Transactions of Indian Society of Desert Technology and University Centre of Desert Studies, Vol. 2, No. 2, p 177-181, Dec. 1977, 6 tab, 8 ref.

Descriptors: *Irrigation effects, *Environmental effects, *Drip irrigation, *Irrigation efficiency, *Soil-water-plant realtionships, *Irrigated systems, Agronomic crops, Evapotranspiration, Plant growth, Crop response, Irrigation design, Water requirements, Trickle irrigation, Saline soils, Saline waters, Agricultural production, Water utilization, Consumptive use, Soil moisture, Arid lands, Sprinkler irrigation, Vegetable crops, India.

Drip or trickle irrigation is a recently developed technique that has been shown to possess many advantages in arid agricultural regions with characteristically saline soils and waters and high evaporation rates. Described here are the results of several field experiments conducted by some of the agricultural universities and research centers in India to determine the comparative effect of: (1) sprinkler, furrow and drip irrigation techniques on musk melons, (2) sprinkler and drip irrigation on cucumbers, (3) irrigation waters of various qualities applied by sprinkler and by drip methods to tomatoes, (4) surface irrigation and drip irrigation on lady fingers, (5) drip and surface methods in the water utilization and yield of tomatoes and Bhendi, (6) a drip system and the traditional system of irrigating bananas and (7) drip irrigation on tomatoes for the agroclimatic conditions of Karnataka. Results indicated that under drip irrigation; (1) the soil ceases to be a factor in holding water between irrigations, (2) the continuous supply of water with the same salinity reduces the progressive concentration of salts and the reduction of soil moisture between irrigations brought about by conventional irrigation methods, and (3) there is no need for precise levelling, erosion is reduced, water distribution is more uniform and there is no surplus water at the end of furrows. It is concluded that drip irrigation is a technique which is particularly suited to arid and desert conditions. (Tickes-Arizona)
W79-08028

CALCULATION OF EVAPORATION DURING THE THREE STAGES OF SOIL DRYING,
Science and Education Administration, Phoenix, AZ. Water Conservation Lab.
For primary bibliographic entry see Field 2D.
W79-08138

FLEXIBLE MULTILAYER TUBULAR STRUCTURE FOR IRRIGATION AND PROCESS FOR ITS PREPARATION,
Mitsui Petrochemical Industries Ltd., Tokyo (Japan). (Assignee).
N. Inoue, I. Furukawa, and T. Usami.
U.S. Patent No. 4,139,159, 11 p, 23 fig, 4 ref; Official Gazette of the United States Patent Office, Vol. 979, No. 2, p 545, February 13, 1979.

Descriptors: *Patents, *Irrigation, *Subsurface irrigation, Irrigation practices, Irrigation efficiency, Application equipment, Drip irrigation.

A plastic tubular irrigating structure is provided for agricultural and other irrigation systems. The structure comprises flexible outer layer of a thermoplastic synthetic resin tube having at least one continuous fin-like heat-sealed portion along its length and watering orifices; and a flexible inner layer as a filter of a water-permeable, water-insoluble sheet, preferably a nonwoven fibrous sheet, fixed partly to the inside of the outer layer. The inner layer is permeable to a larger amount of water than the outer layer. In the absence of water supply, the structure is a flattened tube, but upon supply of water, it assumes an expanded tubular shape. (Sinha-OEIS)
W79-08217

SYSTEM FOR AUTOMATIC FORWARD BOW ALIGNMENT ON WATER DRIVE PIVOT,
Heinzman Engineering, Inc., Grand Island, NE. (Assignee).
J. C. Groelz.
U.S. Patent No. 4,139,018, 9 p, 5 fig, 4 ref; Official Gazette of the United States Patent Office, Vol. 979, No. 2, p 498, February 13, 1979.

Descriptors: *Patents, *Irrigation, *Irrigation systems, Lateral conveyance structures, Irrigation practices, Irrigation efficiency, Application equipment.

An automatic forward bow alignment system permits alignment of the towers of a water drive pivot irrigator. The system has: a valve assembly associated with each of the towers of the irrigator for regulating movement of the tower in a direction of rotation of the irrigator; and a sensor provided on the irrigator for detecting alignment of each of the towers along a predetermined desired forward which the irrigator is to assume, and controlling the valve assembly of the towers as a function of alignment and misalignment of the towers with respect to one another. The valve assembly of each of the towers includes a pair of valves mounted on the irrigator; a reversing arrangement mounted on the irrigator and connected to the valves for selectively holding one of the valves closed and one of the valves open; and a linkage mounted on the irrigator and connected to the valves and to the sensor for closing the other open valve when the associated one of the towers moves ahead of the desired bow which the towers are to follow about their pivot. (Sinha-OEIS)
W79-08218

SOIL IRRIGATION SYSTEM,
Verdyol International A. G., Allschwill (Switzerland). (Assignee).
H. G. Lloyd.
U.S. Patent No. 4,140,421, 8 p, 20 fig, 6 ref; Official Gazette of the United States Patent Office, Vol. 979, No. 3, p 968, February 20, 1979.

Descriptors: *Patents, *Irrigation systems, *Subsurface irrigation, Irrigation practices, Irrigation efficiency, Application equipment, Distribution systems.

A soil irrigation system comprises subterranean distribution pipes for distributing water to overlying soil. Each pipe has a perforated upper wall whose outer surface is covered with water permeable means for preventing the overlying soil from fouling the perforations. The remaining wall structure of the pipe retains the water permeable means in its covering relationship. The water permeable means is a unitary layer of capillary material which, in addition to its antifouling function, aids in equilizing the outflow of water from all the performations of the pipe. The retaining means is integral with the upper wall and is provided with a pair of inwardly projecting cams which overlie and secure the unitary layer of capillary material. It is constructed to prevent any water flow laterally out of the unitary layer and the outflow of water is constrained to move only in an upward direction. (Sinha-OEIS)
W79-08235

INTERRELATIONS OF THE PHYSICAL PROPERTIES OF COPPICE DUNE AND VESICULAR DUNE INTERSPACE SOILS WITH GRASS SEEDLING EMERGENCE,
Texas A and M Univ., College Station. Dept. of Range Science; and Max C. Fleischmann Coll. of Agriculture, Reno NV. Renewable Natural Resources Div.
For primary bibliographic entry see Field 2G.
W79-08348

MORE AND BETTER USES COULD BE MADE OF BILLIONS OF GALLONS OF WATER BY IMPROVING IRRIGATION DELIVERY SYSTEMS: DEPARTMENT OF AGRICULTURE AND THE INTERIOR,
Comptroller General of the United States, Washington, DC.
For primary bibliographic entry see Field 8A.
W79-08353

IRRIGATION OF LOWVELD SUGARCANE,
J. E. Lonsdale.
Rhodesia Science News, Vol. 10, No. 8, p 204-205, August 1976. 1 fig, 1 tab.

Descriptors: *Irrigation systems, *Sugarcane, *Furrow irrigation, Surface irrigation, Sugar crops, Irrigation operation and maintenance, Irrigation practices, Furrow drainage, Flush and trickle irrigation, Drip irrigation, Evaporation.

Experimental evidence suggests that the total water requirement of sugarcane is approximately 1,600 mm per annum. The effective rainfall of the southeastern Lowveld is 400 mm. The additional 1,200 must be supplied as irrigation; if application efficiency is 80%, this figure is increased to 1,500 mm. The young crop has lower water requirements; a pan factor of 0.5 is recommended until the crop has developed a 25% canopy. Thereafter, until a 50% canopy has developed, a pan factor of 0.7 is recommended. A variety of irrigation systems has been used in the Lowveld. In furrows, normally the water supply is shut off and the syphon pipes removed when the water reaches the end of the furrow. A better distribution has been obtained with the 'flush and trickle' method: soil is wetted by a large flush which is then reduced to a trickle when the water reaches the end of the furrow. Drip irrigation is being investigated and developed locally. Efficient drains which can remove excess water, and injurious salts are necessary to prevent the build up of salts in the soil. Drainage will also prevent build-up of underground water tables which reduce the oxygen available to sugarcane roots. Major technical changes are likely to occur within the furrow irrigation system as it continues to be the commonest and most important system in the Lowveld. More water saving measures are also predicted. (Schaefer-IPA)
W79-08361

THE SCHEDULING OF IRRIGATION,
Fruit and Fruit Technology Research Inst., Stellenbosch (South Africa).
For primary bibliographic entry see Field 4B.
W79-08363

TECHNOLOGICAL SUCCESS, URBAN GROWTH, AND RURAL DEPOPULATION: THE MALLEE OF SOUTH AUSTRALIA,
Flinders Univ. of South Australia, Bedford Park.
R. L. Heathcote, and M. Williams.
Economic Geography, Vol. 53, No. 4, p 385-387, Oct 1977, 2 ref.

Descriptors: *Farm management, *Economic efficiency, *Regional analysis, *Community development, Wind erosion, Urbanization, Cost-benefit analysis, Productivity, Social aspects, Social impact, Droughts, Australia, Rural sociology, Desertification.

The history and efforts of one man's family to farm a 1200 hectare plot in South Australia is reviewed here in an attempt to illustrate the physical, economic, and social consequences of desertification. In an area which receives an average of 340 mm of annuals rainfall, this man, with the help of his wife and two sons, has had a continuous fight with drought and wind erosion for the last 50 years. Although this family has achieved a moderate degree of technological success, evidenced by its $100,000 investment in sophisticated farm machinery, they are eeking out only small profits from their crops and livestock. Facing the rising costs of needed seed, fertilizer and equipment and the ever-present dangers of drought and wind erosion, this family must now choose between migration, changing cropping patterns, or increasing their land holding. The growing isolation and deterioration of the communities in this and surrounding areas is adding yet another deterrent to the stability of this region. (Tickes-Arizona)
W79-08368

PRODUCTIVITY OF IRRIGATED TROPICAL GRASSES UNDER DIFFERENT CLIPPING FREQUENCIES IN THE SEMI-DESERT REGION OF THE SUDAN,
Khartoum Univ. (Sudan). Faculty of Agriculture.
A. E. Osman.
Journal of Range Management, Vol. 32, No. 3, p 182-185, May 1979. 3 tab, 13 ref.

Descriptors: *Irrigation effects, *Crop production, *Forage grasses, *Range grasses, *Crop response, *Cutting management, Pasture management, Agronomic crops, Feeds, Biochemistry, Sudan, Proteins.

In the semiarid region of Sudan where 300 mm of annual rainfall supports natural vegetation consisting mainly of annual grasses, irrigated pastures are a potential source of good quality reliable forage. Treating these grasses as an irrigated crop rather than as a weed, this study compares the persistence and productivity of 2 native and 5 introduced warm-season grasses under 3 frequencies of clipping when irrigation was adequate. All species of grasses, both native and introduced, were seeded on 2 x 5 m plots in April 1976, irrigated every week, cut to 14 cm on July 10, 1976 and subjected to 3 cutting frequencies; at 2, 4 and 6 week intervals. Results indicated that buffel grass, rhodes grass, bambasti panic grass and green panic grass produced generally higher yields than para grass, blue panic and switch grass with clipping at 3 and 6 week intervals during the summer resulting in greater total annual yields than clipping at 2 week intervals. Grasses clipped at 2 week intervals were, however, twice as high in crude protein percentage as those clipped at 6 week intervals. With switch grass, para grass and blue panic grass the least able to withstand clipping, it is concluded that buffel, green panic, bambasti panic and rhodes grasses harvested at 4 week intervals are the best choices for production of forage in irrigated pastures in semiarid Sudan. (Tickes-Arizona)
W79-08374

EFFECT OF NITROGEN RATES, MULCHING AND ANTITRANSPIRANTS ON WATER USE AND WATER USE EFFICIENCY OF BARLEY (CHORDEUM VULGARE L.) VARIETIES GROWN UNDER DRY LAND CONDITIONS,
Indian Agricultural Research Inst., New Delhi. Div. of Agronomy.
S. K. Agarwal, and D. E. Rajat.
Journal of Agricultural Science, Vol. 92, p 263-268, 1979, 3 fig, 18 ref.

Descriptors: *Evapotranspiration control, *Mulching, *Antitranspirants, *Evaporation control, *Barley, *Efficiencies, Crop response, Nitrogen compounds, Water conservation, Crop production, Water requirements, Foliar application, Sprays, Kaolin, India, Dry farming.

Described is a field experiment conducted at the Indian Agricultural Research Institute at New Delhi during the winter seasons of 1972-3 and 1973-4 to determine the effects of nitrogen rates, mulching, and foliar application of antitranspirants on the soil water use of varieties of barley. Carried out on a sandy loam soil with a water-holding capacity of about 150 mm/m soil depth, this experiment was laid out in a split plot design in which the effects of 0, 30, and 60 kg of nitrogen on Ratna and Vijaya varieties of barley were determined in main plots, and mulch and antitranspirant effects were measured in sub-plots of 10.8 x 2.3 M. A wheat straw mulch was applied uniformly between rows three weeks after sowing and Kaolin was sprayed on the foliage as a 6% water suspension 45 and 65 days after sowing. Sowing was done by hand plough in the 3rd week of October. Each treatment was replicated three times. Results indicated that although total water use was not significantly different under the various treatments, the straw mulch and Kaolin decreased evapotranspiration at tillering and pre-flowering stages, making more water available at the critical stages of grain formation. It is concluded that nitrogen, straw mulch, and Kaolin coating techniques increase the water use efficiency of barley under these conditions. (Tickes-Arizona)
W79-08378

WILLAMETTE BASIN COMPREHENSIVE STUDY OF WATER AND RELATED LAND RESOURCES: APPENDIX F -- IRRIGATION.
Pacific Nothwest River Basins Commission, Portland, OR. Willamette Basin Task Force.
For primary bibliographic entry see Field 3B.
W79-08439

4. WATER QUANTITY MANAGEMENT AND CONTROL

4A. Control Of Water On The Surface

PROTECTION OF THE BANKS OF THE AMUDAR'YA RIVER FROM DEYGISH BY HYDROMECHANICAL MEANS,
For primary bibliographic entry see Field 2J.
W79-08145

PROCEEDINGS OF A SEMINAR ON NONSTRUCTURAL FLOOD PLAIN MANAGEMENT MEASURES,
Hydrologic Engineering Center, Davis, CA.
For primary bibliographic entry see Field 2E.
W79-08173

ENVIRONMENTAL PLANNING FOR THE METROPOLITAN AREA CEDAR-GREEN RIVER BASINS, WASHINGTON. PART II. URBAN DRAINAGE STUDY. APPENDIX C:STORM WATER MONITORING PROGRAM,
Army Engineer District, Seattle, WA. Seattle District.
For primary bibliographic entry see Field 2E.
W79-08181

FLOOD PLAIN INFORMATION: MAHONING RIVER, TRUMBULL COUNTY, OHIO, NILES-MCDONALD-GIRARD-WEATHERSFIELD TOWNSHIP.
Army Engineer District, Pittsburgh, PA.
For primary bibliographic entry see Field 2E.
W79-08187

FLOOD PLAIN INFORMATION: MAHONING RIVER AND CRAB CREEK, MAHONING COUNTY, OHIO, YOUNGSTOWN-CAMPBELL-STRUTHERS-LOWELLVILLE,
Army Engineer District, Pittsburgh, PA.
For primary bibliographic entry see Field 2E.
W79-08188

FLOOD PLAIN INFORMATION: MAHONING RIVER, TRUMBULL COUNTY, OHIO, CITY OF WARREN-LEAVITTSBURG, WARREN AND HOWLAND TOWNSHIPS,
Army Engineer District, Pittsburgh, PA.
For primary bibliographic entry see Field 2E.
W79-08189

SPECIAL FLOOD HAZARD INFORMATION REPORT: WALNUT CREEK, MANSFIELD, TEXAS,
Army District, Fort Worth, TX.
For primary bibliographic entry see Field 2E.
W79-08190

SPECIAL FLOOD HAZARD INFORMATION REPORT: WHITE OAK CREEK, DIBOLL, TEXAS.
Army Engineer District, Fort Worth, TX.
For primary bibliographic entry see Field 2E.
W79-08191

FLOOD HAZARD ANALYSES, CARIBOU STREAM, CITY OF CARIBOU, AROOSTOOK COUNTY, MAINE,
Soil Conservation Service, Orono, ME.
For primary bibliographic entry see Field 2E.
W79-08192

FLOOD HAZARD ANALYSES: LITTLE OSSIPEE RIVER, TOWN OF LIMINGTON, MAINE - YORK COUNTY.
Soil Conservation Service, Orono, ME.
For primary bibliographic entry see Field 2E.
W79-08193

FLOOD HAZARD ANALYSES: GREAT WORKS RIVER, TOWN OF SOUTH BERWICK, MAINE, YORK COUNTY,
Soil Conservation Service, Orono, ME.
For primary bibliographic entry see Field 2E.
W79-08194

FLOOD HAZARD ANALYSES: GREAT WORKS RIVER, TOWNS OF NORTH BERWICK AND SANFORD, MAINE - YORK COUNTY,
Soil Conservation Service, Orono, ME.
For primary bibliographic entry see Field 2E.
W79-08195

MULTI-GOAL ANALYSIS OF A SHORT-RUN RESERVOIR OPERATION,
Milan Univ. (Italy). Inst. di Elettrotecnica ed Elettronica and Consiglio Nazionale delle Ricerche, Milan (Italy). Centro di Teoria dei Sistemi.
G. Ambrosino, G. Fronza, G. Guariso, and A. Karlin.
Applied Mathematical Modelling, Vol. 3, No. 3, p 221-227, June 1979. 8 fig, 25 equ, 10 ref, 1 append.

Descriptors: *Multi-goal programming, *Reservoir operation, *Optimization, *Lakes, *Decision making, *Benefit maximization, *Flood minimization, *Algorithms, Reservoir storage, Reservoir releases, Downstream recreation, Water management(Applied), Methodology, Pareto-optimal alternatives, Search algorithm, Lake Maggiore(Italy), Equations, Mathematical models, Systems analysis, Water flow.

Multi-goal mathematical programming is applied to a water resource management problem concerning the regulation of a reservoir which releases water to downstream users and has recreational activities located on its sides. Pointed out are the efficient tradeoffs to be considered when operating a lake with the two objectives of maximizing the payoff from releasing water downstream and minimizing floods on the lakesides. The Pareto-optimal alternatives are found by an efficient search algorithm without applying the standard generating techniques of multi-goal programming. Similar properties are expected to hold also in other reservoir short-term regulation problems where the operating policy has to consider both drought situations (such as low flows as water quality indexes and flood events). The application of the analysis to a real situation (a lake in Northern Italy) is given in detail. (Bell-Graf--Cornell)
W79-08206

RAKE DEVICE FOR REMOVING WEEDS FROM LAKES,
L. H. Thompson, and A. Goplen.
U.S. Patent No. 4,137,693, 6 p, 8 fig, 8 ref; Official Gazette of the United States Patent Office, Vol. 979, No. 1, p 46, February 6, 1979.

Descriptors: *Patents, *Weeds, *Aquatic weeds, *Aquatic weed control, Equipment, Lakes, Rakes.

A portable frame is mounted on a beach adjacent to a lake. The frame has a reversible motor and a pair of drive wheels driven by the motor. A rake with an elongated handle is provided. The drive wheels of the frame are adapted to engage the handle of the rake to move it backward and forward powered by the motor. The rake has teeth which fold inward when the rake is moved forward into the lake along the lake floor and the teeth will remain upright when the rake is powered back out of the lake, so that the teeth will engage the weeds and will take or pull the weeds out of the bottom of the lake as the rake is powered back out of the lake. (Sinha-OEIS)
W79-08229

EFFECT OF THE SUWANNEE RIVER SILL ON OKEFENOKEE SWAMP WATER LEVEL,
Georgia Univ., Athens. Dept. of Zoology.
J. T. Finn, and E. J. Rykiel, Jr.
Water Resources Research, Vol. 15, No. 2, p 313-320, April 1979. 4 fig, 5 tab, 21 ref. OWRT A-060-GA(2), NSF DEB76-12292.

Descriptors: *Swamps, *Georgia, *Water levels, *Rivers, *Dams, Effects, Variability, Drainage, Spillways, Streamflow, Precipitation(Atmospheric), Evapotranspiration, Regression analysis, Vegetation, Nutrients, On-site investigations, Data processing, *Okefenokee Swamp(GA), *Suwannee River(GA), River sills, Swamp water levels.

An 11-cm increase in mean water level at the Camp Cornelia boat basin in Okefenokee Swamp is attributable to the Suwannee River sill. This increase represents about 45% of the average total increase after sill construction. The remaining 55% can be explained as natural variation in the hydrologic cycle. A reduction of about 18-30% of the normal variation in water level has occurred since sill construction. Apparent surface water gradients have been substantially altered, and the potential impact area may approach 28% of the total swamp area. Changes in hydroperiod and water level amplitude in the sill impact area may affect the floristic character of the Okefenokee Swamp over the long term. (Sims-ISWS)
W79-08339

INSTITUTIONAL CONSTRAINTS ON LAND MANAGEMENT FOR WATER RESOURCE PROTECTION IN URBAN AND SUBURBAN WATERSHEDS,
New York Univ., NY. Graduate School of Business Administration.
For primary bibliographic entry see Field 6E.
W79-08341

NITROGEN, PHOSPHORUS, ORGANIC CARBON, AND BIOCHEMICAL OXYGEN DEMAND IN FLORIDA SURFACE WATERS, 1972,
Geological Survey, Tallahassee, FL. Water Resources Div.
M. I. Kaufman, and J. E. Dysart.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-296 229 Price codes: A03 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 78-43, 1978. 33 p, 14 fig, 5 tab.

Descriptors: *Nitrogen, *Phosphorus, *Surface waters, *Florida, Baseline studies, Biochemical oxygen demand, Organic matter, Nutrients, Chemistry of precipitation, Water quality, Water quality standards, Histograms, Data collections, Water analysis, Sampling, Sites, Regional analysis, Organic carbon.

Water samples were collected during spring and autumn 1972 from about 100 surface-water sites in Florida. The samples were analyzed for the plant nutrients, nitrogen and phosphorus. In most waters, nitrogen concentrations are less than 2.0 milligrams per liter as nitrogen, and organic nitrogen is dominant. Median total nitrogen concentration for Florida surface waters is between 1.2 and 2.0 milligrams per liter as nitrogen. In samples from 85 percent of the sites, total nitrogen exceeded 0.6 milligrams per liter. Median total phosphorus concentration as phosphorus for Florida surface waters is between 0.05 and 0.1 milligrams per liter. The information will form a base useful to agencies concerned with setting concentration limits for nitrogen and phosphorus in industrial and sewage plant outfalls. (Woodard-USGS)
W79-08384

THE WILLAMETTE BASIN COMPREHENSIVE STUDY OF WATER AND RELATED LAND RESOURCES: MAIN REPORT,
Pacific Northwest River Basins Commission, Portland, OR. Willamette Basin Task Force.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A036 745, Price codes: A08 in paper copy, A01 in microfiche. 1969, 155 p, 4 maps.

Descriptors: *Planning, *Water resources, *Land resources, *Programs, *Projects, *River basin development, *Willamette River(OR), Regional analysis, Oregon, Land development, Water resources development, Fish management, Natural resources, Wildlife management, Navigation, Water quality, Water supply, Power marketing, Cost analysis, Economy, Population, Environmental effects, Flood control, Water pollution control, River basins, Environmental management.

This volume is the Main Report of a study undertaken to plan for the proper development of water and related land resoucres of the Willamette River Basin in Oregon. This need is made critical because the population of the area is expected to triple by 2020. Problems addressed by the study are flood control and prevention, irrigation development, drainage and erosion control, fish management, municipal and industrial water supply, water quality control, recreational development, navigation and power needs. The plan consists of a number of elements which can be grouped into three categories: those projects and programs existing or assured; those early-action projects and programs needed in the next 10-15 years; and those long-range projects and programs which would meet needs developing from 1980 to 2020. First the Basin is described--its land, stream systems, vegetation, climate, and natural resources. The study area's economy by income, employment, and industries is discussed. Population, existing and projected, is summarized. Present resource use and development is then inventoried by studying storage development, functional purposes, and water mangement programs, including water rights and water use programs. Problems of flood control, irrigation, power, navigation, recreation, water quality and supply, fish and wildlife, watershed protection, and environmental considerations are summarized. The plan is next presented. Its formulation procedure is discussed, costs are enumerated, and specific plan elements reviewed. Eleven subbasins of the Willamette Basin and their plans are summarized. Suggestions for implementation are presented. (See also W79-08434 thru W79-08445) (Zayac-NC)
W79-08433

WILLAMETTE BASIN COMPREHENSIVE STUDY OF WATER AND RELATED LAND RESOURCES: APPENDIX A--STUDY AREA.
Pacific Northwest River Basins Commission, Portland, OR. Willamette Basin Task Force.
For primary bibliographic entry see Field 4C.
W79-08434

WILLAMETTE BASIN COMPREHENSIVE STUDY OF WATER AND RELATED LAND RESOURCES: APPENDIX B--HYDROLOGY,
Pacific Northwest River Basins Commission, Portland, OR. Willamette Basin Task Force.
For primary bibliographic entry see Field 2A.
W79-08435

WILLAMETTE BASIN COMPREHENSIVE STUDY OF WATER AND RELATED LAND RESOURCES: APPENDIX E--FLOOD CONTROL.
Pacific Northwest River Basins Commission, Portland, OR. Willamette Basin Task Force.
For primary bibliographic entry see Field 6F.
W79-08438

WILLAMETTE BASIN COMPREHENSIVE STUDY OF WATER AND RELATED LAND RESOURCES: APPENDIX H--MUNICIPAL AND INDUSTRIAL WATER SUPPLY.
Pacific Northwest River Basins Commission, Portland, OR. Willamette Basin Task Force.
For primary bibliographic entry see Field 3B.
W79-08441

WILLAMETTE BASIN COMPREHENSIVE STUDY OF WATER AND RELATED LAND RESOURCES: APPENDIX K--RECREATION,
Pacific Northwest River Basins Commission, Portland, OR. Willamette Basin Task Force.
For primary bibliographic entry see Field 6B.
W79-08444

FLOOD PLAIN INFORMATION: SHREVEPORT, LOUISIANA, NO. 3, LOGAN AND CHOCTAW BAYOUS,
Army Engineer District, New Orleans, LA.
For primary bibliographic entry see Field 2E.
W79-08446

FLOOD PLAIN INFORMATION: CUYAHOGA RIVER, MANTUA AND HIRAM, PORTAGE COUNTY, OHIO,
Army Engineer District, Buffalo, NY.
For primary bibliographic entry see Field 2E.
W79-08447

FLOOD PLAIN INFORMATION: MISSISSIPPI RIVER AND RIPPLE RIVER, AITKIN, MINNESOTA,
Army Engineer District, St. Paul, MN.
For primary bibliographic entry see Field 2E.
W79-08448

4B. Groundwater Management

ARTIFICIAL GROUNDWATER RECHARGE AND ITS RELEVANCE IN BRITAIN,
Water Research Centre, Medmenham (England). Medmenham Lab.
K. J. Edworthy, and R. A. Downing.
Journal of the Institution of Water Engineers and Scientists, Vol. 33, No. 2, p 151-172, March 1979. 9 fig, 1 tab, 51 ref.

Descriptors: *Groundwater recharge, *Artificial recharge, *Water management(Applied), *On-site tests, Injection wells, Pit recharge, Foreign re-

search, On-site investigations, Reviews, Water quality, Design criteria, Irrigation, Recharge ponds, Recharge wells, Performance, Clogging, Water storage, *Great Britain.

The design criteria for artificial recharge works were reviewed, and the cost of incorporating recharge in water resource schemes in Britain was discussed. The conclusions were: (1) Artificial recharge experiments carried out in Britain over the last 10 years have confirmed that: (a) the technique is applicable in the main aquifers, (b) average recharge rates of between 0.3 and 0.5 m/d can be anticipated where lagoons are used to recharge aquifers such as the Permo-Triassic sandstones and the Lower Greensand: in the case of wells, recharge rates similar to abstraction rate are likely, and (c) the quality of a water is improved by recharge through an unfissured aquifer. (2) Studies with mathematical models have suggested that recharge of the Chalk where it crops out and is drained by perennial streams, should be feasible In many circumstances. (3) It has been shown theoretically that even a limited amount of recharge can make a significant difference to minimum storage levels in coastal aquifers. (4) Development of artificial recharge on a regional scale would in many cases cost between 8 p and 10 p/ cu m. (5) Maximum use of aquifer storage requires artificial recharge. (6) Artificial recharge is often introduced into water resource systems for reasons of water quality. The quality of the supply to consumers can be manipulated to maintain acceptable standards, even where the source of supply is periodically susceptible to contamination. The natural purification afforded by aquifers, the long residence time, and the mixing of different waters in aquifers all act as safeguards for supply. (Humphreys-ISWS)
W79-08266

TENSIOMETERS AND IRRIGATION SCHEDULING,
Fruit and Fruit Technology Research Inst., Stellenbosch (South Africa).
F. C. Van Rooyen.
The Deciduous Fruit Grower, Vol. 27, No. 2, p 402-407, November 1977. 3 fig, 1 tab, 4 ref.

Descriptors: *Tensiometers, *Irrigation, *Soil-water-plant relationships, Soil water, Tension, Instrumentation, Irrigation efficiency, Irrigated land, Manometer, Pressure measuring instruments, Bourdon vacuum meter, Scheduling, Soil moisture, Soil moisture meters.

The practical aspects of the use of tensiometers in irrigation scheduling are examined. Tensiometers measure the relative wetness of the soil, and the two basic types, the mercury manometer and the Bourdon vacuum meter, both work on the same principles. A porous ceramic head is connected by a plastic tube to a manometer or vacuum meter. The system is filled with water and inserted into the soil. Water moves through pores of the head until equilibrium of tension is reached between the water in the head and in the surrounding soil. If the soil dries out further, tension increases in the instrument and is registered on the manometer or vacuum meter. When used correctly tensiometers are excellent and reliable instruments to be used in irrigation scheduling; however, often the user has a deficiency of knowledge regarding assembly, preparation, maintenance, and installation of the instrument. Assembly is usually detailed in users' manuals. The plastic tube must be completely filled with air-free water; the ceramic head must be saturated with water; the scale must be adjusted to a zero reading. Regular servicing is essential. Tensiometers should be installed in representative spots at each soil layer. Readings should be taken and recorded at least every second or third day depending on soil texture. (Schaefer-IPA)
W79-08362

THE SCHEDULING OF IRRIGATION,
Fruit and Fruit Technology Research Inst., Stellenbosch (South Africa).
F. C. Van Rooyen.
The Deciduous Fruit Grower, Vol. 26, Part 10, p 384-391, October 1976. 3 fig, 1 tab.

Descriptors: *Scheduling, *Irrigation practices, *Irrigation efficiency, Soil water, Instrumentation, Tensiometers, Evaporation pans, Evapotranspiration, Soil moisture, Soil water movement, Soil-water-plant relationships, Irrigated land, Saturated soils, Soil moisture meters, Consumptive use.

The purposes and procedures for implementing irrigation scheduling are presented. Details are given for two techniques to measure water consumption by plants. Reasons for irrigation scheduling include increased crop yields, the ever-growing shortage of water, present ineffective irrigation techniques including over-irrigation, and the desire to reclaim the large amounts of capital invested in irrigation schemes. Most agricultural crops cannot absorb any water at all through the roots when soil moisture tension reaches 220 pounds per sq inch. This point is known as the permanent wilting point (PWP) because the result of PWP is permanent damage caused by wilting. The point at which soil is saturated (adding more water will only cause drainage) is called the field-water capacity (FWC or FC) and differs from soil to soil. The basis of good irrigation is the balance between the consumptive use of water by the plant (CU) and the sum of irrigation plus rainfall. The Class-A evaporation pan measures CU by using the principle of evapotranspiration (ET), a combination of evaporation (E) and transpiration (T). The evaporation from the pan multiplied by a crop factor is equal to the soil ET or CU. The tensiometer is a direct-reading instrument for determining soil moisture tension in situ. This instrument must be placed in the ground so that it is representative of the relevant soil types. (Schaefer-IPA)
W79-08363

AVAILABILITY OF ADDITIONAL GROUND-WATER SUPPLIES IN THE PASCAGOULA AREA, MISSISSIPPI,
Geological Survey, Jackson, MS. Water Resources Div.
B. E. Wasson.
Mississippi Research and Development Center, 1978. 32 p, 11 fig, 3 tab, 16 ref.

Descriptors: *Groundwater resources, *Water quality, *Aquifer characteristics, *Mississippi, *Groundwater availability, Water supply, Chemical analysis, Water wells, Pumping, Water yield, Drawdown, Water levels, Water utilization, Saline water intrusion, Hydrogeology, Projections, Water demand, *Pascagoula area(Miss).

During 1960-77, ground-water pumping for municipal supply and industrial use in the Pascagoula area, Mississippi, approximately doubled to about 22 Mgal/d (million gallons per day). The freshwater aquifers, approximate depths to aquifers, and the ground water used in 1977 were as follows: Citronelle Formation, depth 200 feet, used less than 1 Mgal/d; Graham Ferry Formation, depth 350 feet, used 12 Mgal/d; 600-foot sand of the Pascagoula Formation, used 2 Mgal/d; 800-foot sand of the Pascagoula Formation, used 7 Mgal/d. The water levels in all wells in the area were above NGVD (National Geodetic Vertical Datum) in 1939, and most water levels were still above NGVD in 1960. In 1977, however, water levels in some wells in the Graham Ferry and the Pascagoula Formations were more than 100 feet below NGVD. In some areas the Citronelle probably could yield more than 8 Mgal/d to well fields; however, a high stress on the Citronelle aquifer probably would cause saltwater intrusion from nearby surface water bodies. Transmissivities and available water levels would allow about twice as much pumping from the Pascagoula and Graham Ferry Formations in the Pascagoula area as the 21-Mgal/d pumping rate in 1977. However, the increased stresses on the aquifers would increase the rate of movement of brackish water northwestward and probably would cause the water in some wells in the south and east parts of Pascagoula to become brackish. (Woodard-USGS)
W79-08387

COMPUTER MODELING OF GROUND-WATER AVAILABILITY IN THE POOTATUCK RIVER VALLEY, NEWTOWN, CONNECTICUT,
Geological Survey, Hartford, CT. Water Resources Div.
For primary bibliographic entry see Field 6A.
W79-08393

4C. Effects On Water Of Man's Non-Water Activities

ENVIRONMENTAL PLANNING FOR THE METROPOLITAN AREA CEDAR-GREEN RIVER BASINS, WASHINGTON. PART II. URBAN DRAINAGE STUDY. APPENDIX C:STORM WATER MONITORING PROGRAM,
Army Engineer District, Seattle, WA. Seattle District.
For primary bibliographic entry see Field 2E.
W79-08181

PROGRESS REPORT ON THE BLACK MESA, ARIZONA, GROUND-WATER MONITORING PROGRAM,
Geological Survey, Flafstaff, AZ. Water Resources Div.
G. W. Levings.
In: Proceedings of the 2d International Technical Conference on Slurry Transportation, Las Vegas, Nevada, March 2-4, 1977. Slurry Transport Association, Washington, District of Columbia, p 94-96, 1977. 3 fig.

Descriptors: *Coal mines, *Strip mines, *Slurries, *Pipelines, *Transportation, Water demand, Groundwater, Aquifers, Withdrawal, Drawdown, Water levels, Potentiometric level, Water supply, Water quality, Monitoring, *Navajo Sandstone aquifer, *Black Mesa(Ariz).

Black Mesa is in northeastern Arizona on the Navajo and Hopi Indian Reservations. In 1970, a coal company began a 35-year project to strip mine approximately 400 million tons of coal from the Wepo Formation of the Mesa Verde Group of Late Cretaceous age. About 150 million tons will be delivered to the Mohave Generating Station near Bullhead City, Arizona, via a 273-mile-long slurry pipeline and the remainder will be transported by rail. An average of 3,200 acre-feet of water per year will be pumped from the Navajo Sandstone aquifer for the slurry pipeline and associated mining operations. The Navajo Sandstone of Late Triassic and Jurassic age is the only aquifer in the area capable of yielding more than 50 gallons per minute of good quality water, and is the source of most of the water used by communities and schools on or around the mesa. Concern has been expressed that water withdrawn for the slurry pipeline and mining operations will lower the potentiometric surface in the Navajo Sandstone aquifer. This could adversely effect the water supplies in the area. The U.S. Geological Survey began a project in 1971 that consists of four activities: water-level monitoring in the Navajo Sandstone aquifer; water-level monitoring in aquifers other than the Navajo Sandstone; monitoring of pumpage from the Navajo Sandstone; and monitoring of water-quality conditions in the Navajo Sandstone. (Woodard-USGS)
W79-08400

TEMPERATURE (TEMPERATURE STANDARDS FOR NATIONWIDE WATER QUALITY MANAGEMENT).
Environmental Protection Agency, Washington, DC. Div. of Water Quality Standards.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-256 351, Price codes: A02 in paper copy, A01 in microfiche. March, 1971, 21 p.

Descriptors: *Water quality control, *Thermal pollution, *Temperature control, Water pollution, Aquatic animals, Water pollution control, Industries, Biological communities, Agriculture, Potable water.

The water quality standards program is directed by the federal Environmental Protection Agency, which has responsibility for approving state-adopt-

ed standards, evaluating adherence to the standards, and overseeing enforcement of standards compliance. The first nationwide strategy for water quality management standards contain four major elements: (1) the use (recreational, drinking, fish and wildlife propogational, industrial or agricultural) to be made of the interstate water; (2) criteria to protect those uses; (3) implementation plans (for needed industrial-municipal waste treatment improvements) and enforcement plans; and (4) an antidegradation statement to protect existing high quality waters. State-adopted temperature standards are surveyed. Temperature standards are set to control thermal pollution, or the amount of heated wastes discharged into water. Thermal pollution creates adverse conditions for aquatic life, accelerates biological in the streams which reduces the dissolved oxygen content of the water, increases the growth of aquatic plants which contributes to taste and odor problems, or otherwise makes the water less suitable for fish and wildlife, domestic, industrial, and recreational uses. (Vloedman-Florida)
W79-08425

WILLAMETTE BASIN COMPREHENSIVE STUDY OF WATER AND RELATED LAND RESOURCES: APPENDIX A--STUDY AREA.
Pacific Northwest River Basins Commission, Portland, OR. Willamette Basin Task Force.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A036 746, Price codes: A07 in paper copy, A01 in microfiche. Chaired by Oregon State Water Resources Board, 1969. 103 p, 19 tab, 6 fig, 5 maps, 42 photos.

Descriptors: *Water resources, *Land resources, *Planning, *Natural resources, *Physical properties, *Resources, *Programs, *Land use, *Water rights, *River basin development, *Willamette River(OR), *Resource utilization, Oregon, Climate, Economy, Soils, Geology, Populations, Institutions, Legal aspects, Water law, Water rights, Surface water, Groundwater, Governments, Agriculture, Minerals, Forest, Laws, River basins, Physiography.

This study was undertaken to plan for the proper development of water and related land resources of the Willamette Basin in Oregon. Appendix A, along with Appendices B and C, provides supporting data for the functional appendices D through L. First studied in detail are the physical characteristics of the basin. Included are reviews of climate, physiography, geology, soils, and social and economic development such as population distribution, employment, transportation, utilities and institutions. Resources are next inventoried. Water is studied by looking at surface and ground water supply and water use; fish and wildlife are discussed, minerals--including nonmetals, metals and fuels--are outlined; the uses of forests and forest lands are described; agriculture is reviewed; and recreational resources are enumerated. Finally, resource utilization objectives and programs are presented. This section describes goals and objectives for both land and water and discusses State laws, policies, and programs, including statute and case law reviews, water rights and the role of governmental agencies. (See also W79-08433) (Zayac--NC)
W79-08434

GRAZING ON WETLAND MEADOWS,
Georgia Univ., Brunswick. Marine Resources Extension Center.
R. J. Reimold.
In: Estuarine Processes, Volume I, Uses, Stresses and Adaptation to the Estuary, M. Wiley, editor, Academic Press, New York, N.Y. 1976. p 219-225. 35 ref.

Descriptors: *Grazing, *Wetlands, *Effects, Marshes, Agriculture, Soils, Compaction, Rooted aquatic plants, Primary productivity, Invertebrates, Detritus, Succession.

Although marshlands were once visualized a potentially productive pasture through ditching, diking and draining, 'cat-clay' problems associated with large quantities of organic matter and anaerobic conditions result in complex polysulfides that, when oxidized, produce extremely acidic soil conditions detrimental to all vegetative growth. The extent of substrate compaction and the species of vegetation determine the feasibility of grazing a wetland area. In grazed Spartina marshes, net primary production was 50% of the production occurring on ungrazed sites. Grazing also had a significant negative impact on the macro-invertebrate populations and resulted in differences in plant successional trends. Grazing also significantly reduced detritus production. Marshes appear to recover from grazing once it is terminated. (Stihler-Mass)
W79-08469

THE EFFECTS OF FIRE ON THE ECOLOGY OF THE BOREAL FOREST, WITH PARTICULAR REFERENCE TO THE CANADIAN NORTH: A REVIEW AND SELECTED BIBLIOGRAPHY,
Canadian Wildlife Service, Delta (British Columbia).
J. P. Kelsall, E. S. Telfer, and T. D. Wright.
Occasional Paper Number 32. 1977. 58 p, 1 fig, 199 ref, 1 append.

Descriptors: *Burning, *Marsh management, *Canada, Wetlands, Wildlife habitat, Forest management, Productivity, Forests, Bogs, Peat, Wildlife.

This review analyzes literature relevant to the effects of fire on the Boreal Forest, and on its related wildlife resources, with particular reference to the Canadian North. Fire rids marshes of dead grass, sedges, and shrubs and makes new shoots available to cattle, furbearers, and waterfowl. Burning releases nutrients from organic litter, usually potassium, calcium, phosphorus, magnesium, and chlorides. The productivity of several major wetland areas in interior Alaska seems to be maintained by two natural factors--periodic flooding and periodic fires. Burning keeps marshes at a subclimax state that is most productive of food such as Scirpus spp. (Steiner-Mass)
W79-08483

WETLANDS, DRAINAGE AND LEISURE,
For primary bibliographic entry see Field 6G.
W79-08489

WILDLIFE HABITAT AS AN INTEGRAL COMPONENT OF A PLANNED UNIT DEVELOPMENT,
Carlozzi, Sinton, and Vilkitis, Inc., Amherst, MA.
J. R. Vilkitis.
Urban Ecology, Vol. 3, No. 2, p 171-187, June, 1978. 8 fig, 1 tab, 3 ref.

Descriptors: *Comprehensive planning, *Bioindicators, Environmental effects, Planning, Long-term planning, Indicators, Analysis, Habitats, Landscaping, Aesthetics, Habitat improvement, Monitoring, Wetlands, Swamps.

A planned unit development (PUD) for 8800 single-family and multiple dwellings was designed and is being implemented to be consistent with the biological resources of the site and ecological parameters set by land form and function. The underlying philosophy was to enhance and maintain natural habitat for wildlife and to improve the aesthetic character of the landscape through diversifying open space, plantings, and waterways. Upon completion of landscape renovation, none of the indigenous species of wildlife known to inhabit the site were displaced due to the total destruction of their habitat. Of the four types of wildlife environments identified (forest edge, wetlands, savanna, and swamp forest) three were enhanced; the swamp forest was not altered and was set aside as a natural preserve. The uplands and improved pasture (savanna) were the areas chosen for development. (Bollinger-Mass)
W79-08490

THE INFLUENCE OF PREHISTORIC CULTURES UPON THE INITIATION AND SPREAD OF BLANKET BOG IN UPLAND WALES,
Kings Coll., London (England). Dept. of Botany.
P. D. Moore.
Nature, Vol. 241, No. 5388, p 350-353, February 2, 1973. 6 fig, 3 tab, 14 ref.

Descriptors: *Bogs, *Grazing, *Lumbering, *Effects, Wetlands, Aquatic plants, Forests, Wales.

Spread of upland peat bogs and the consequent demise of former woodlands is usually attributed to climatic changes; however, the early human activities of woodland clearance and stock grazing may have hastened this vegetational regression. This hypothesis is supported by pollen data from a shallow peat near Barmouth in Merioneth, Wales. (Stihler-Mass)
W79-08499

4D. Watershed Protection

IMPACT OF VARIOUS RANGE IMPROVEMENT PRACTICES ON WATERSHED PROTECTIVE COVER AND ANNUAL PRODUCTION WITHIN THE COLORADO RIVER BASIN,
Utah State Univ., Logan.
I. K. Hessary, and G. F. Gifford.
Journal of Range Management, Vol. 32, No. 2, p 134-140, March, 1979, 10 fig, 6 ref.

Descriptors: *Land clearing, *Watershed management, *Range management, *Bush control, *Productivity, *Chemical analysis, *Pollutant identification, Pasture management, Revegetation, Water conservation, Hydrologic systems, Dissolved solids, Environmental effects, Soil salinity, Water salinity, Infiltration, Runoff, Rainfall-runoff relationships, Gully plugs, Contour furrows, Plant communities, Chaining, Sagebrush, Vegetation effects, Colorado River Basin, Juniper trees, Pinyon pine trees.

The Upper and Lower Colorado River Basins are contributing to an increase in salinity in the Colorado River. Since chemical constituents are an integral part of the hydrologic system, studies have been made of various range improvement practices in Colorado, Utah, New Mexico, and Arizona, in an effort to determine the impact of such treatments on salinity as gully plugs, contour furrowing, pitting, pinyon-juniper chaining, and various sagebrush control treatments. Comparisons of treated vs. untreated sites provide data on the relative success of these various practices on watershed cover and annual production: (1) 33 percent of the contour furrowed sites had significant increases in annual production, (2) annual production under pinyon-juniper chaining increased on a variety of soil types, (3) pitting on clay and sandy clay loam showed no increase in annual production, but rather a significant reduction in the clay soils, and (4) less than 50 percent of the various sagebrush treatments showed an increase, with plowing the least successful. It is hoped that the practical application of range improvement practices will lead to land management programs that will influence infiltration and surface runoff, thus helping reduce the diffuse salt production from wildland watersheds. (Tickes-Arizona)
W79-08018

PREDICTION OF SEDIMENT BASIN PERFORMANCE,
Kentucky Univ., Lexington. Dept. of Agricultural Engineering.
A. D. Ward, C. T. Haan, and B. J. Barfield.
Transactions of the American Society of Agricultural Engineers, Vol. 22, No. 1, p 126-136, January-February 1979. 16 fig, 1 tab, 17 ref, 1 append. OWRT B-046-KY(5). 14-34-0001-6081.

Descriptors: *Sediment control, *Sediments, *Basins, *Model studies, Mathematical models, Erosion, Construction, Strip mines, Particle size, Runoff, Legislation, Hydrographs, Settling basins, Trap efficiency, Discharge(Water), Water pollution, Water pollution control, Sediment basins.

Public Law 92-500 requires the control and reduction of point and nonpoint pollution to meet the 1983 water quality standards. Current legislation in several states requires the use of sediment detention basins to control pollution from strip mining and construction activities. It is envisaged that sediment basins may be employed successfully to control the nonpoint pollution associated with agriculture and silviculture. This paper presented a mathematical model for describing the sedimentation characteristics of detention basins. Using data generated by the model, the significance of the factors determining sediment deposition in estimating basin trap efficiency and peak effluent sediment concentrations was analyzed. Regression equations were presented for estimating trap efficiency and peak effluent sediment concentrations from basins equipped with either a perforated riser or a drop inlet riser. The effects of selective withdrawal from the basin were studied as well as the effect of sediment accumulations in the basin on the trap efficiency. The model was tested in simulation studies on several actual basins and appeared to give a good estimate of measured trap efficiencies. (Sims-ISWS)
W79-08337

WATER IN THE DAKOTA FORMATION, HODGEMAN AND NORTHERN FORD COUNTIES, SOUTHWESTERN KANSAS,
Geological Survey, Lawrence, KS. Water Resources Div.
D. H. Lobmeyer, and E. C. Weakly.
Kansas Geological Survey Irrigation Series 5, 1979. 41 p, 13 fig, 6 tab, 37 ref.

Descriptors: *Groundwater resources, *Aquifer characteristics, *Water yield, *Water quality, *Kansas, Water wells, Withdrawal, Water supply, Municipal water, Irrigation wells, Hydrogeology, Water levels, Groundwater recharge, Water analysis, Chemical analysis, *Dakota formation, *Hodgeman County(Kans), *Ford County(Kans).

The water-yielding sandstone beds of the Dakota Formation in Hodgeman and northern Ford Counties, Kans., differ greatly in thickness, extent, and cementation. Wells in the Dakota commonly yield an adequate supply of water for domestic and stock use. Locally, municipal and irrigation wells obtain 100 to 2,000 gallons per minute from thick, loosely cemented sandstone beds. The annual pumpage from irrigation wells in the area ranges between about 7,700 and 15,000 acre-feet. The sandstone aquifers are recharged by water from overlying unconsolidated aquifers and by subsurface inflow from the south and west. Natural discharge is mainly by seeps and springs in the outcrop area along the Pawnee River and its tributaries. Water in the sandstone beds contains from 300 to 1,400 milligrams per liter dissolved solids, has a medium to very high salinity hazard, and has a low to very high sodium hazard. (Woodard-USGS)
W79-08396

THE WILLAMETTE BASIN COMPREHENSIVE STUDY OF WATER AND RELATED LAND RESOURCES: MAIN REPORT,
Pacific Northwest River Basins Commission, Portland, OR. Willamette Basin Task Force.
For primary bibliographic entry see Field 4A.
W79-08433

WILLAMETTE BASIN COMPREHENSIVE STUDY OF WATER AND RELATED LAND RESOURCES: APPENDIX G- LAND MEASURES AND WATERSHED PROTECTION.
Pacific Northwest River Basins Commission, Portland, OR. Willamette Basin Task Force.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A036 759, Price codes: A14 in paper copy, A01 in microfiche. Chaired by Soil Conservation Service, 1969. 267 p, 1 addendum, 47 tab, 18 maps, 4 fig.

Descriptors: *Agriculture, *Land management, *Forestry, *Watershed management, *Watershed protection, *River basin development, Oregon, Agricultural watersheds, Agricultural runoff, Agricultural engineering, Land reclamation, Land development, Land resources, Soil conservation, Demonstration watersheds, Crops, Farm management, Land classification, Rural areas, Forest management, Erosion control, Carrying capacity, Forest soils, Sediment control, Forest watersheds, Watersheds(Basins), Forests, River basins, *Willamette River(OR).

This study was undertaken to plan for the proper development of water and related land resources of the Willamette River Basin in Oregon. Appendix G, one of the functional appendices, is based in part on data contained in the 3 supporting appendices, A through C. The general goal is to modify land and water resource use to avoid impairment of the environment and to repair damage already done. Specifically involved are the prevention of excessive erosion, control of storm and sediment damage, and improvement of quality and quantity of water runoff. The appendix identifies measures and programs intended to insure the maintenance or enhancement of the agriculture and forestry environment; that the resource base (soil, water, vegetation) is capable of producing required outputs and that future demands on the resource base can be met. Present status of both agriculture and forestry is assessed. With agriculture, the land capability classification system is described, land use is inventoried and land and water related problems are discussed. In forestry, the characteristics of various forest areas are described, both by zone and for each of 11 subbasins. Forest land disturbances are reviewed, watershed management programs assessed, and forestry problems presented. Future demands on agriculture are studied through land use adjustments, rural land use and development, and possible land measures. Future demands on forestry are reviewed by studying forest land use as related to water and probable future problems--physical, economic and social, and institutional. Management concepts, ongoing programs and research needs are described for agriculture; basinwide alternatives are presented for forestry. (Zayac-NC)
W79-08440

5. WATER QUALITY MANAGEMENT AND PROTECTION

5A. Identification Of Pollutants

MERCURY CONCENTRATIONS IN THREE SPECIES OF TUNAS COLLECTED FROM VARIOUS OCEANIC WATERS,
National Marine Fisheries Service, Milford, CT. Experimental Biological Investigations.
R. A. Greig, and J. Krzynowek.
Bulletin of Environmental Contamination and Toxicology, Vol. 22, p 120-127, 1979. 4 tab, 11 ref.

Descriptors: *Mercury, *Tissue analysis, *Bioaccumulation, *Tuna, *Albacore, *Skipjack, *Yellowfin, Chemical analysis, Commercial fishing, Atlantic Ocean, Pacific Ocean, Indian Ocean, Heavy metals, Marine fish, Path of pollutants, Size, Hawaii, Commercial fish.

Frozen tuna were sampled at dockside holding facilities of commercial fishing operations. Both muscle and liner samples were analyzed for total mercury concentration. Tissue mercury levels for three species from the Pacific, Atlantic and Indian Oceans ranged from 0.033 to 0.707 ppm. Attempts to attribute varying levels to specific geographical regions were unsuccessful. Mercury concentrations did vary as a function of length of tuna for albacore and skipjack (from Hawaii). A significant correlation was not found in skipjack from the eastern Atlantic. (Deal-EIS)
W79-08035

RELIABILITY OF AQUATIC INSECTS VERSUS WATER SAMPLES AS MEASURES OF AQUATIC LEAD POLLUTION,
Colorado Div. of Wildlife, Montrose.
R. B. Nehring, R. Nisson, and G. Minasian.
Bulletin of Environmental Contamination and Toxicology, Vol. 22, p 103-108, 1979. 3 fig, 4 tab, 4 ref.

Descriptors: *Analytical techniques, *Lead, *Aquatic insects, *Bioconcentration, *Tissue analysis, *Iran, Chalus River, Dptera, Mayflies, Stoneflies, Chemical analysis, Spectrophotometry, Heavy metals, Path of pollutants, Water chemistry, Bottom sediments, Water pollution effects.

The purposes of the study were to: (1) evaluate the accuracy of the concentration factor method in determining the amount of lead pollution in the Chalus River (Iran), and (2) determine if several orders of aquatic insects would give repeatable results comparable to water sample analysis by flame atomic absorption spectrophotometry. Initial laboratory experiments indicated that the mechanism of lead uptake and loss varied with the type of exposure, making field determination of concentration factors essential. Subsequently, concentration factors were determined for six groups of aquatic insects. These concentration factors were used to estimate lead levels in the stream during subsequent sampling. Estimated stream lead levels and those determined by spectrophotometry rarely differed by more than 0.1 mg/L. (Deal-EIS)
W79-08036

FATE AND EFFECTS OF CADMIUM IN AN EXPERIMENTAL MARINE ECOSYSTEM,
Biologische Anstalt Helgoland, Hamburg (Germany, F. R.).
Dethlefsen V. von Westernhagen, H. Rosenthal, G. Furstenberg, and J. Klinckmann.
Helgolander wissenschaftliche Meeresuntersuchungen, Vol. 31, p 471-484, 1978. 4 fig, 1 tab, 33 ref.

Descriptors: *Cadmium, *Mussels, *Toxicity, *Bioaccumulation, *Tissue analysis, *Plaice, Ecosystems, Aquaria, Filters, Chemical analysis, Path of pollutants, Growth rates, Bioindicators, Fish physiology, Animal metabolism, Sludge, Water quality, Water chemistry, Metals, Commercial fish, Commercial shellfish.

Two recirculated marine seawater systems were used for the study on cadmium accumulation of biological filter sludge, by the mussel and the plaice for a period of up to 300 days. In the contaminated system Cd concentrations varied from 2.5 to 7.0 microgram/l with a mean of 4.6 + or - microgram/l (control: 1.04 + or - 0.46 microgram/l). Accumulation of Cd by the filter sludge from the control system as well as from the contaminated system was significant. Accumulation of Cd by M. edulis both in the control and in the contaminated system was considerable. After 163 days of exposure the whole body burden of mussels rose from 0.3 ng Cd/mg dry wt to around 10 ng Cd/mg dry wt in the controls and to 70 ng Cd/mg dry wt in the contaminated systems. Accumulation of Cd by P. platessa was analysed in backbone, fins, gills, liver, muscle (fillet), otolith and skin (dorsai and ventral) over a period of 280 days. Elevated Cd contents of livers from control specimens were noticed after 200 days and reached 1.75 ng Cd/mg dry wt in liver. There was considerable accumulation in the liver (maximum values: 3.0 ng Cd/mg dry wt) and gills (6.0 ng Cd/mg dry wt) of specimens from the contaminated system, Cd contents of plaice exposed for identical periods of time were very variable. Growth of plaice living in the contaminated system was at times significantly slower than that of the control group. Of the three biological objects tested-filter sludge, M. edulis, P. platessa-the mussel seemed to be the most sensitive indicator of elevated Cd-concentrations, while the reaction of the plaice was slow and less distinct. (Deal-EIS)
W79-08037

DETERMINATION OF THE ABSORPTION OF CR+6 AND CR+3 IN AN ALGAL CULTURE OF CHLORELLA PYRENOIDOSA USING 51CR,
Roskilde Univ. Center (Denmark). Inst. for Environment, Technology and Society.
H. Schroll.
Bulletin of Environmental Contamination and Toxicology, Vol. 20, p 721-724, 1978. 1 tab, 3 ref.

Descriptors: *Chlorella, *Chromium, *Absorption, *Bioaccumulation, Cytological studies, Aquatic algae, Radioactivity techniques, Tracers, Chemical analysis, Path of pollutants, Chlorophyta, Growth rates, Ions.

The purpose of this experiment was to determine if Cr(+6) and Cr(+6) would be equally absorbed in a green algae culture of Chlorella pyrenoidosa when Cr-51 was used as a tracer. Identical Chlorella pyrenoidosa cultures were exposed to either Cr(+6) or Cr(+3) and analyzed after 3, 21 and 32 hours. Cr(+3) concentrations in the algae increased with each time interval while Cr(+6) levels decreased. From this it was concluded that Cr(+6) had an inhibiting effect on growth while Cr(+3) did not. (Deal-EIS)
W79-08038

INVESTIGATION ON THE DISTRIBUTION OF DDT AND AROCLOR 1254 IN LABORATORY-GROWN MARINE PHYTOPLANKTON,
Institut Rudjer Boskovic, Rovinj (Yugoslavia). Center for Marine Research.
M. Picer, N. Picer, F. Krsinic, and V. Sipos.
Bulletin of Environmental Contamination and Toxicology, Vol. 21, p 743-748, 1979. 4 fig, 10 ref.

Descriptors: *DDT, *Aroclors, *Phytoplankton, *Adsorption, *Dunaliella, Polychlorinated biphenyls, Pesticide kinetics, Path of pollutants, Chlorinated hydrocarbon pesticides, Marine algae, Chemical analysis, Gas chromatography.

Laboratory cultures of Dunaliella tertiolecta were innoculated with organochlorine compounds. Distribution of the compounds was investigated by chromatography after 2, 24, 48, 216 and 360 hr of phytoplankton growth. The distribution curve of low solubility organochlorine compounds was very complex and unpredictable. (Deal-EIS)
W79-08039

MOBILIZATION AND ACCUMULATION OF SEDIMENT BOUND HEAVY METALS BY ALGAE,
Ottawa Univ. (Ontario). Dept. of Biology.
V. Laube, S. Ramamoorthy, and D. J. Kushner.
Bulletin of Environmental Contamination and Toxicology, Vol. 21, p 763-770, 1979. 2 fig, 2 tab, 19 ref.

Descriptors: *Cadmium, *Copper, *Anabaena, *Bottom sediments, *Bioaccumulation, Cytological studies, Cyanophyta, Aquatic algae, Path of pollutants, Heavy metals, Sediments, Water chemistry, Sorption, Chemical analysis, Phytoplankton.

The kinetics of cadmium and copper were studied in river water, sediment and algae (Anabaena, Ankistrodesmus). When the heavy metal ions were added to the water, they were taken up by both the algae and sediment. Anabaena was more efficient in metal ion accumulation than Ankistrodesmus. When the source of the metal ions was the sediment, algae accumulated considerable amounts of heavy metal ions. These results suggest that in natural systems algae may play a very important role in mobilizing sediment-bound heavy metal ions. (Deal-EIS)
W79-08040

EFFECTS OF HEAVY METALS ON BENTHIC MACROINVERTEBRATE DENSITIES IN FOUNDRY COVE ON THE HUDSON RIVER,
New York Univ. Medical Center, NY. Inst. of Environmental Medicine.
T. J. Occhiogrosso, W. T. Waller, and G. J. Lauer.
Bulletin of Environmental Contamination and Toxicology, Vol. 22, p 230-237, 1979. 1 fig, 4 tab, 12 ref.

Descriptors: *Cadmium, *Nickel, *Sediments, *Distribution patterns, Heavy metals, Fish food organisms, Iron, Zinc, Cobalt, Manganese, Benthic fauna, Industrial wastes, Chemical wastes, Bottom sediments, New York, Foundry Cove, Benthos, Hudson River.

The sediments of Foundry Cove (New York) are contaminated with a number of heavy metals, particularly cadmium and nickel. This report examined the relationship of the sediment and the numbers and/or kinds of macroinvertebrate organisms observed in the sediments. Ten sites were sampled in 1973 and 1974. Bottom sediments were found to contain significant levels of manganese, iron, zinc, cobalt, cadmium and nickel. Cadmium levels up to 48,100 ppm and nickel levels of 11,400 ppm were detected. The stations with the highest contamination levels had the lowest densities of macroinvertebrates. The ability of fish food organisms to survive in highly contaminated sediments greatly increases the potential for biological magnification. (Deal-EIS)
W79-08042

THE EFFECT OF THE LIMING OF FISH-BREEDING PONDS ON SOME CRUSTACEAN PLANKTERS,
Ukrainian Research Inst. of the Fish Industry, Kiev (USSR).
S. A. Krazhan, N. N. Kharitonova, and S. A. Isayeva.
Hydrobiological Journal, Vol. 14, No. 2, p 31-33, 1978. 3 tab, 8 ref.

Descriptors: *Toxicity, *Zooplankton, *Lime, Crustaceans, Copepods, Fish farming, Aquiculture, Daphnia, Mortality, Fertilizers, Fecundity, Animal physiology, Calcium carbonate, Nutrients.

Application of lime to ponds at rates of 500 and 1500 kg/ka is destructive to cladoceran crustaceans (survival 11 percent) and inhibits hatching of copepod young, but has almost no effect on their adult forms. The greatest number of zooplankters dies during the first few days after lime application. To preserve the planktonic crustaceans it is essential to apply the lime uniformly (preferably by spraying) at doses not exceeding 150 to 300 kg/ha combining liming with a subsequent application of mineral fertilizers. (Deal-EIS)
W79-08044

BROWN PELICAN: POPULATION STATUS, REPRODUCTIVE SUCCESS AND ORGANOCHLORINE RESIDUES IN LOUISIANA, 1971-1976,
Fish and Wildlife Service, Corvallis, OR. Patuxent Wildlife Research Center.
L. Blus, E. Cromartie, L. McNease, and T. Joanen.
Bulletin of Environmental Contamination and Toxicology, Vol. 22, p 128-135, 1979. 3 tab, 21 ref.

Descriptors: *Pesticide residues, *Bird eggs, *Pelicans, DDT, DDD, DDE, Polychlorinated biphenyls, Dieldrin, Endrin, Chlorinated hydrocarbon pesticides, Louisiana, Animal populations, Reproduction, Pesticide toxicity.

The purpose of this report is to further interpret the impact of organochlorine residues on population status and reproductive success of Louisiana brown pelicans. The pelicans were transplanted from Florida to Louisiana between 1968 and 1976. They began breeding in 1971 and the breeding population increased each year until a disastrous die-off in 1975 reduced the population 40%. Eggshell thickness means of pelican eggs from 1971 through 1976 averaged 6.7 to 13.5 less than the mean thickness for eggs collected before 1947. All of the eggs analyzed contained residues of DDE and PCBs. Most eggs also contained residues of DDD, dieldrin and endrin. (Deal-EIS)
W79-08047

TOXICITY AND TERATOGENICITY OF AROMATIC AMINES TO XENOPUS LAEVIS,
Oak Ridge National Lab., TN.
J. M. Dumont, T. W. Schultz, and R. D. Jones.
Bulletin of Environmental Contamination and Toxicology, Vol. 22, p 159-166, 1979. 3 fig, 4 tab, 16 ref.

Descriptors: *Toxicity, *Embryonic growth stage, *Frogs, *Xenopus, *Tissue analysis, *Aniline, *Quinoline, *Pyridine, *Teratogen, Mortality, Mode of action, Organic compounds, Aromatic compounds, Coals, Fuels, Chemical wastes, Animal behavior.

This report examined the toxicity and teratogenicity of several pure aromatic amines known to be present in coal conversion process waters on the early embryonic stages of the South African clawed frog, Xenopus laevis. Quinoline was more toxic to Xenopus embryos than either aniline of pyridine. The toxicity of quinoline and its 2-methyl derivative was equal, but the toxicity of the 2,6-dimethyl derivative was four times greater. The mortality rates of Xenopus embryos exposed to various concentrations of quinoline and 2-methylquinoline suggest two modes of action for these compounds. The curves for 2,6-dimethylquinoline suggested a single mode of action. In general, size, motility, pigmentation, and rate of development were inversely related to concentration. (Deal-EIS)
W79-08048

CLEARANCE OF ARSENIC INGESTED BY MAN FROM ARSENIC CONTAMINATED FISH,
Fisheries and Marine Service, Halifax (Nova Scotia).
H. C. Freeman, J. F. Uthe, R. B. Fleming, P. H. Odense, and R. G. Ackman.
Bulletin of Environmental Contamination and Toxicology, Vol. 22, p 224-229, 1979. 1 fig, 1 tab, 8 ref.

Descriptors: *Path of pollutants, *Animal metabolism, *Arsenic compounds, *Arsenic, *Bioaccumulation, Public health, Arsenic excretion, Animal physiology, Chemical analysis, Commercial fishing, Spectrophotometry, Pollutant identification, Digestion, Metals, Humans.

The clearance of total arsenic, by urinary excretion from six volunteers who ate two consecutive meals of commercial fish containing naturally high levels of arsenic is described. During the day prior to consuming the fish, very little arsenic was excreted in the urine of any of the participants. The quantities of arsenic eliminated in the urine over this period ranged from 1.5 to 9.8 micrograms (mean 4.8 micrograms). Two hours following the first meal each subject excreted a significant quantity of arsenic. Two days after eating the fish over 50% of the arsenic ingested had been excreted. The mean total arsenic excreted for all six men up to the ninth day was 77 plus or minus 11% of the 5 mg of arsenic ingested. The remainder of the arsenic may have been retained in the body or may have been excreted via other mechanisms such as fecal or respiratory routes. (Deal-EIS)
W79-08049

A BIOASSAY FOR THE TOXICITY OF SEDIMENT TO MARINE MACROBENTHOS,
Pacific Northwest Environmental Research Lab., Newport, OR. Marine Science Center.
R. C. Swartz, W. A. DeBen, and F. A. Cole.
Journal of the Water Pollution Control Fed., Vol. 51, p 944-950, 1979. 1 fig, 4 tab, 9 ref.

Descriptors: *Dredging, *Toxicity, *Benthic fauna, *Polychaetes, Washington, Texas, Virginia, New Jersey, Duwamish River, Bioassay, Amphipoda, Trophic level, Sediments, Crustaceans, Particle size, Waste disposal, Mortality, Animal physiology, Houston Ship Channel, Bailey Creek, Raritan River, Coos Bay.

A bioassay has been developed to determine the acute toxicity of the settleable phase of dredged material to the marine benthos. Five benthic invertebrates representing different taxonomic and trophic positions were allowed to acclimate to control (nonpolluted) sediment and were then covered by a layer of either test or control sediment. Mean survival after 10 days of exposure was significantly different from the control for sediment from the Duwamish River (WA.), Houston Ship Channel (TX.), Bailey Creek (VA.), and the Raritan River (NJ.), but there was no significant difference for sediment from Coos Bay and Skipanon River (OR.). There were substantial interspecific differences in survival among the five test species. The most sensitive species was the infaunal amphipod, Paraphoxus epistomus. (Deal-EIS)
W79-08053

Group 5A—Identification Of Pollutants

THRESHOLDS FOR DETECTION AND FEEDING BEHAVIOR IN THE DUNGENESS CRAB, CANCER MAGISTER (DANA),
Battelle Pacific Northwest Labs., Sequim, WA. Marine Research Lab.
W. H. Pearson, P. C. Sugarman, and D. L. Woodruff.
Journal of Experimental Marine Biology and Ecology, Vol. 39, p 65-78, 1979. 2 fig, 2 tab, 32 ref.

Descriptors: *Animal behavior, *Crabs, *Predation, *Chemoreceptors, Clams, Animal physiology, Crustaceans, Food habits, Chemical properties, Water temperature, Laboratory tests.

After observation and description of feeding behavior, the chemosensory ability of the Dungeness crab was measured with sea-water solutions of a freeze-dried extract of the littleneck clam, Protothaca staminea (Conrad). An abrupt change in antennular orientation accompanied by a specified increase in the antennular flicking rate indicated that a crab detected the food extract. The threshold concentration at which 50% of the crabs detected the calm extract was 0.0000000001 g/l. At 0.01 g/l crabs probed the substratum with the chelae and/or showed other feeding behavior. The chemosensory abilities of the Dungeness crab were compared with those of other crustaceans. (Deal-EIS)
W79-08054

THE MARINE ALGAE OF ELIE, SCOTLAND: A RE-ASSESSMENT,
Heriot-Watt Univ., Edinburgh, (Scotland). Dept. of Brewing and Biological Sciences.
M. Wilkinson, and I. Tittley.
Botanica Marina, Vol. 22, p 249-256, 1979. 2 fig, 6 tab, 22 ref.

Descriptors: *Marine algae, *Monitoring, *Species diversity, *Scotland, Path of pollutants, Dominant organisms, Biological communities, Chlorophyta, Phaeophyta, Rhodophyta, Aquatic algae, Water pollution effects, Ecological distribution, Firth of Forth.

No change has been found between the survey of Traill in 1888 and the present work in the species richness of marine algae at Elie on the north coast of the Firth of Forth in Scotland. This is compared to Joppa and Dunbar on the south coast of the Firth of Forth where, in the case of the former, a great species reduction has occurred since Traill's time, while it has not occurred at Dunbar. The changes are in accord with the likely distribution of pollutants in the Forth. Comparison of changes in detailed species recordings and in numerical species richness is made in relation to pollution monitoring schemes. It is suggested that those pollution monitoring schemes which rely solely on quantitative distributional data of common species are inadequate and that some estimate of species richness should be included in such schemes. (Deal-EIS)
W79-08058

RESPIRATORY RESPONSES OF LARGEMOUTH BASS (MICROPTERUS SALMOIDES) TO ENVIRONMENTAL CHANGES IN TEMPERATURE AND DISSOLVED OXYGEN,
California Univ., Davis. Dept. of Wildlife and Fisheries Biology.
J. J. Cech, Jr., C. G. Campagna, and S. J. Mitchell.
Transactions of the American Fisheries Society, Vol. 108, p 166-171, 1979. 2 fig, 2 tab, 15 ref.

Descriptors: *Respiration, *Bass, *Water temperature, *Dissolved oxygen, *Tissue analysis, Fish physiology, Animal metabolism, Oxygen requirements, Mortality, Drought tolerance, Chemical analysis, Hydrogen ion concentration, Bass.

Respiratory metabolic rates of largemouth bass were measured in flow-through respirometers under various temperature and dissolved oxygen conditions simulating drought environments. 'Critical' oxygen tensions increased from < 40 torr PO2 at 20 C, to 40-50 torr at 25 C, to 50-60 torr at 30 C. Evidence from arterial blood samples indicated increased anaerobic metabolism associated with an oxidative metabolic depression at high temperatures and low dissolved oxygen concentrations. Procedures to maintain 2.60 mg O2/liter at 25 C and 2.85 mg O2/liter at 30 C in largemouth bass habitats should minimize adult mortalities linked to insufficient oxygen. (Deal-EIS)
W79-08059

EFFECT OF SALINITY AND MANGANESE ON MEDIDOTEA ENTOMON,
All-Union Research Inst. of Marine Fisheries and Oceanography, Moscow (USSR).
A. F. Karpevich, and A. T. Shurin.
Hydrobiological Journal, Vol. 14, No. 1, p 72-77, 1978. 6 fig, 8 ref.

Descriptors: *Salinity, *Manganese, *Toxicity, *Isopods, *Bioaccumulation, *Tissue analysis, Baltic Sea, Dissolved oxygen, Chlorides, Metals, Mortality, Inhibition, Animal metabolism, Respiration, Animal physiology, Oxygen demand.

It was found in short- and long-term experiments that M. entomon from the Pyarnz and Riga Gulfs is capable of survival in the salinity range of 3 to 14%, and tolerates an oxygen concentration of 1.0 to 1.4 ml/liter, as well as a manganese chloride concentration of 2.5 to 12 mg/liter. Manganese chloride concentrations of 17 to 20 mg/liter are critical, since at these concentrations significant quantities of manganese accumulate in organs and tissues, inhibiting metabolism, depressing activity, and ultimately causing death of these isopods. (Deal-EIS)
W79-08060

AN ENVIRONMENTAL CHAMBER FOR MONITORING 'IN SITU' GROWTH AND SURVIVAL OF LARVAL FISHES,
National Marine Fisheries Service, Narragansett, RI. Narragansett Lab.
G. C. Laurence, T. A. Halavik, B. R. Burns, and A. S. Smigielski.
Transactions of the American Fisheries Society, Vol. 108, p 197-203, 1979. 1 fig, 4 tab, 19 ref.

Descriptors: *On-site data collections, *Fish populations, *On-site tests, *Flounder, Analytical techniques, Larval growth stage, Monitoring, Predation, Zooplankton, Growth rates, Mortality, Water chemistry, Dissolved oxygen, Salinity, Water temperature, Productivity, Fish food organisms, Methodology.

An 'in situ' experiment using an environmental chamber to monitor growth and survival of laboratory-produced winter flounder larvae (Pseudopleuronectes americanus) was completed in the Pettaquamscutt Estuary of Narragansett Bay. The prototype enclosure was of open mesh allowing the larvae to be exposed to natural, varying conditions. One thousand larvae were stocked in the chamber where they remained for a 2-week period. Zooplankton prey concentrations, temperature, salinity, and dissolved oxygen were monitored day and night both inside and outside the chamber. Survival rate was 76.8% and all the survivors metamorphosed. Daily specific growth rates were 10.7% dry weight and 1.9% standard length. Sample analyses indicated physical conditions were good for winter flounder growth and that zooplankton prey densities were high. There were no statistically significant differences between prey densities inside and outside the chamber. This research was considered to be a 'transitional study' linking laboratory and field research, and results were comparable with previous laboratory and field studies. (Deal-EIS)
W79-08061

CRASSOSTREA VIRGINICA AS AN INDICATOR OF LEAD POLLUTION,
Environmental Research Lab., Narragansett, RI.
G. E. Zaroogian, G. Morrison, and J. F. Heltshe.
Marine Biology, Vol. 52, p 189-196, 1979. 5 fig, 22 ref.

Descriptors: *Lead, *Oysters, *Bioindicators, *Crassostrea, *Tissue analysis, *Bioaccumulation, *Depuration, Growth rates, Chemical analysis, Heavy metals, Salinity, Water temperature, Path of pollutants, Adsorption, Toxicity.

After treatment with 1.0 and 3.3 micrograms Pb Kg/l for 20 weeks in flowing seawater at ambient salinity and temperature, Crassostrea virginica accumulated as much as 6.57 and 11.42 micrograms Kg/l dry weight, respectively, and no mortalities were recorded. Lead uptake was curvilinear; however, the general trend was an increase in lead concentration over time. Dry weight of the oyster had no significant relation with tissue lead concentration however, a significant positive relationship existed between weight and lead content. A decrease in lead concentration in the tissues occurred from mid-August to mid-September despite continuous addition of lead to the seawater. Addition of lead to the seawater was terminated after 20 weeks (October), and lead loss was studied for the following 12 weeks. Lead loss was studied well after spawning in an attempt to eliminate any influence this might have on lead concentration in the tissues. After 4 weeks, approximately 54% accumulated lead was lost under conditions of a natural temperature decline. The biological half-life of lead in C. virginica tissues was calculated to be 5.5 weeks. In the ensuing 8 weeks, little or no lead loss was observed. Larvae from each treatment developed to the straight-hinged stage within 48 h with no apparent abnormalities. Lead appeared to have no adverse effect on larvae when parents had been treated with 1.0 and 3.3 micrograms Kg/l seawater for 10 weeks. (Deal-EIS)
W79-08064

BEHAVIORAL CHANGES IN BLUEGILL (LEPOMIS MACROCHIRUS) AS INDICATORS OF SUBLETHAL EFFECTS OF METALS,
Iowa State Univ., Ames. Dept. of Animal Ecology.
M. G. Henry, and G. J. Atchison.
Environmental Biology of Fish, Vol. 4, No. 1, p 37-42, 1979. 2 tab, 23 ref.

Descriptors: *Fish behavior, *Toxicity, *Zinc, *Cadmium, Metals, Mode of action, Fish physiology, Sunfishes, Bioindicators, Water quality standards, Bioassay, Animal behavior, Bluegill sunfish, Monitoring.

The development of rapid, yet sensitive toxicity testing methods is needed for the establishment of water quality standards to protect aquatic life. A technique using changes in the behavior of bluegill was utilized to evaluate the impact of five sublethal levels of a cadmium and zinc mixture. The technique proved very sensitive and various changes in behavior occurred at the lowest metal levels used; 21 micrograms Cd per liter and 99 micrograms Zn per liter. Coughs, Yawns, partial jerks and jerk swimming were especially sensitive indicators of elevated metal levels. The frequency, but not the form, of eight of the nine behaviors quantified changed significantly with increasing metal levels. (Deal-EIS)
W79-08065

DDT INDUCED ETHOLOGICAL CHANGES IN ESTUARINE FISH,
Centre of Advanced Study in Marine Biology, Porto Novo (India).
T. Lingaraja, P. S. B. Rao, and V. K. Venugopalan.
Environmental Biology of Fish, Vol. 4, No. 1, p 83-88, 1979. 7 fig, 6 ref.

Descriptors: *DDT, *Fish behavior, *Pesticide toxicity, Predation, Mode of action, Fish food organisms, Feeding rates, Perches, Mullets, Bioindicators, Estuarine environment, Chlorinated hydrocarbon pesticides, Water pollution effects.

Experiments were carried out to study the feeding rates of the predator fish Therapon jarbua (Forsk) on mullet juveniles, before and after treatment with DDT. Mullet juveniles treated with a subacute concentration were refused by the control predators, whereas predators treated with a subacute concentration consumed more mullet juveniles. In the present study crescent perch (T. jarbua) were exposed to subacute and acute concentrations of DDT and their behaviour was compared with that of the control predators. There were changes in oriented behaviour and co-ordin-

ated movements, and in feeding, aggression and comfort behaviour of the fish. Inflammation in the gills and caudal fin serration were noticed in treated fishes. The findings presented here throw light on fundamental pathways by which pollutants interact with the behaviour of fishes. (Deal-EIS)
W79-08066

EVIDENCE OF WEIGHT-DEPENDENT DIFFERENTIAL HEMATOLOGICAL RESPONSE TO INCREASED ENVIRONMENTAL TEMPERATURE BY CARP, CYPRINUS CARPIO,
Brock Univ., St. Catherines (Ontario). Dept. of Biological Sciences.
J. S. Smeda, and A. Houston.
Environmental Biology of Fishes, Vol. 4, No. 1, p 89-92, 1979. 1 fig, 2 tab, 13 ref.

Descriptors: *Water temperature, *Carp, *Fish physiology, *Hemopoesis, *Tissue analysis, Weight, Size, Calcium, Animal metabolism, Oxygen requirements, Chemical analysis, Growth rates, Regression analysis, Hematology, Biochemistry.

Hematological response to increased temperature was evaluated in carp acclimated to 2 degrees, 16 degrees and 30 degrees C by reference to hemoglobin level, hematocrit red cell number and mean crythrocytic volume and hemoglobin content. Although only modest variations were observed in terms of mean values, regression of these parameters against weight indicated that response in smaller specimens greatly exceeded that of larger animals. Variations in red cell numbers and hemoglobin were well correlated with plasma calcium, and it is suggested that temperature-induced hypercalcemia may play some role in the triggering of hemopoesis. (Deal-EIS)
W79-08067

STRUCTURE RELATED UPTAKE OF CHLORINATED PARAFFINS IN BLEAKS (ALBURNUS ALBURNUS L),
National Swedish Environment Protection Board, Studsvik (Sweden). Brackish Water Toxicology Lab.
B.-E. Bengtsson, O. Svanberg, E. Linden, G. Lunde, and E. B. Ofstad.
Ambio, Vol. 8, No. 2-3, p 121-122, 1979. 1 fig, 1 tab, 9 ref.

Descriptors: *Absorption, *Fish physiology, Oil, Oil spills, *Bleak, *Alburnus, *Paraffins, *Chlorinated paraffins, *Bioaccumulation, *Tissue analysis, Organic compounds, Chlorination, Animal metabolism, Chemical analysis, Polychlorinated biphenyls, Chemical properties, Toxicity, Fish behavior.

The uptake from the water of chlorinated paraffins (CP) with various carbon chain lengths and various levels of chlorination was studied in bleaks, Alburnus alburnus L. Subsequent elimination from the fish, when placed in clean water, was also traced. CPs with short carbon chain lengths and low levels of chlorination showed the highest uptake. The CP's had a lower uptake than the tested PCB formulation, but demonstrated a comparatively high retention. Symptoms of toxic effects of CPs were also noted. (Deal-EIS)
W79-08073

SPECIFIC AND NONSPECIFIC CHANGES INDUCED IN FISH BY VARIOUS TOXIC AGENTS,
Akademiya Nauk URSR, Kiev. Inst. Hidrobiologii.
A. Ya. Malyarevskaya.
Hydrobiological Journal, Vol. 14, No. 2, p 52-59, 1978. 6 tab, 27 ref.

Descriptors: *Toxicity, *Fish physiology, *Mode of action, *Tissue analysis, Animal metabolism, Chemical properties, Cyanophyta, DDT, Enzymes, Proteins, Organic compounds, Mortality, Respiration, Inhibition, Carp, Perches, Chemical analysis, Pesticide toxicity, Trichlorfon.

The concepts of 'specific' and 'nonspecific' changes are formulated. A comparison is made, on the basis of the author's own and literature data, of the disturbances in metabolic processes induced in fish by agents of differing origin and chemical structure such as metabolites and toxins of blue-green algae, DDT, and Trichlorfon. Comparison of the changes in respiration, protein metabolism, cholinesterase activity, and content of nicotinamide coenzymes made it possible to identify the general and the specific in the mechanisms of action of these agents on fish. (Deal-EIS)
W79-08074

DYNAMICS OF ZINC-65 SPECIFIC ACTIVITY AND TOTAL ZINC IN BENTHIC FISHES ON THE OUTER CONTINENTAL SHELF OFF CENTRAL OREGON,
Oregon State Univ., Corvallis. School of Oceanography.
H. A. Vanderploeg.
Marine Biology, Vol. 52, p 259-272, 1979. 7 fig, 5 tab, 31 ref.

Descriptors: *Fish physiology, *Absorption, *Zinc radioisotopes, *Tissue analysis, *Bioaccumulation, *Flounder, Path of pollutants, Size, Marine fish, Food webs, Zinc, Fish food organisms, Radioecology, Radiochemical analysis, Tracers, Benthic fauna, Mathematical models, Chemical properties.

The dynamics of 65Zn specific activity and total zinc in benthic fishes on the outer continental shelf off central Oregon were examined. A differential equation that relates specific activity of 65Zn in fish to that in fish food was used to estimate a's (zinc uptake-rate coefficients) for 3 different size classes of the flounder Lyopsetta exilis, and for 1 size class of the flounder Microstromus pacificus. The a's obtained for L. exilis were very close to the a obtained in the laboratory for the flounder Pleuronectes platessa. The a estimated for M. pacificus was very much smaller than the a's estimated for the other two species. A model that related a to predicted weight-specific feeding rates suggested that the smaller a of M. pacificus was caused by a low absorption efficiency of zinc from its prey. Sensitivity studies indicated that time histories of specific activity in the fishes are not sensitive to moderate changes in a. The negative correlation between specific activity in the diet and in the weight of L. exilis was the major cause of the negative correlative between specific activity and weight in this species. In M. pacificus, where composition of diet does not vary with size, specific activity was independent of weight. The time history of specific activity in M. pacificus was very much lower than those in the different size classes of L. exilis, a result caused mainly by the much lower specific activity of the prey of M. pacificus. Differences in specific activity among other benthic fishes were also correlated with differences in specific activity of their prey. The food-web dynamics responsible for these patterns are discussed. (Deal-EIS)
W79-08075

UPTAKE AND LOSS OF RADIOACTIVE CADMIUM BY THE SEA-SKATER HALOBATES ROBUSTUS (HETEROPTERA: GERRIDAE),
Institut fuer Meeresforschung, Bremerhaven (Germany, F.R.).
M. Schulz-Baldes, and L. Cheng.
Marine Biology, Vol. 52, p 253-258, 1979. 3 fig, 20 ref.

Descriptors: *Cadmium radioisotopes, *Absorption, *Insects, *Tissue analysis, *Bioaccumulation, *Sea-skaters, *Halobates, Bioassay, Radiochemical analysis, Tracers, Path of pollutants, Cadmium, Animal physiology, Animal metabolism, Water chemistry, Radioactivity, Techniques.

Sea-skaters caught around the Galapagos Islands, were exposed over a period of 3 days to radioactive cadmium dissolved in seawater. Although 115mcd (metastable 115Cd) was accumulated by the insects, they did not concentrate it above the seawater level. The experiments clearly showed that cadmium is taken up into the body, not merely adsorbed onto surfaces. The uptake of Cd followed a biphasic time course. When sea-skaters labelled in this way were transferred back into unlabelled seawater, the rate of loss of Cd was likewise biphasic. During uptake and loss, the biological half-life times for the first compartments were almost identical (0.64 and 0.79 h), indicating that the same compartment might be involved. On the other hand, the biological half-life times for the second compartments were different (1.7 days during uptake, 19.5 days during loss), indicating that the site or chemical form of bound Cd in the sea-skater had changed. (Deal-EIS)
W79-08076

THE EFFECT OF NUTRITION ON THE RESPONSE OF FIELD POPULATIONS OF THE CALANOID COPEPOD ACARTIA TONSA TO COPPER,,
Environmental Research Lab., Narragansett, RI.
S. L. Sosnowski, D. J. Germond, and J. H. Gentile.
Water Research, Vol. 13, p 449-452, 1979. 2 fig, 15 ref.

Descriptors: *Copepods, *Copper, *Toxicity, Bioassay, Mortality, Lethal limit, Zooplankton, Aquatic populations, Algae, Phytoplankton, Population, Chlorophyll, Chemical analysis, Metals, Predation, Biomass, Seasonal, Narragansett Bay.

Continuous flow toxicity tests were conducted on field populations of adult Acartia tonsa collected from Narragansett Bay. Potential algal food at the collection site was estimated from ATP and chlorophyll analysis. Integration of these data with quantitative zooplankton analysis established that A. tonsa had a significant grazing effect on algal biomass (P 0.05). The natural population dynamics of A. tonsa during this period were assessed from microscopic analysis of tow material. The sensitivity of A. tonsa to total copper ranged from 9.0 to 78.0 micrograms/l for 72 h LC50's. Results show an inverse correlation (P 0.05) between the log LC50 and adult A. tonsa density at the time of collection. The relationship between A. tonsa sensitivity to copper and the food ration (algal density/A. tonsa density) has been described by a quadratic function which has a correlation coefficient of 0.78. This indicates that the log LC50 increases with increasing food ration up to a point and then remains constant. A comparison of confidence intervals about the LC50's indicates greater variability in the response of field animals compared to previous studies with cultured populations. This data suggests that field populations of A. tonsa can be expected to exhibit a wide range of sensitivity to other pollutants. Sensitivity is strongly correlated with population density and food ration. (Deal-EIS)
W79-08079

THE EFFECTS OF MONOCHLORAMINE ON SELECTED RIVERINE FISHES,
Wisconsin Univ.-Milwaukee. Dept. of Zoology.
G. L. Seegert, A. S. Brooks, J. R. V. Castle, and K. Gradall.
Transactions of the American Fisheries Society, Vol. 108, p 88-96, 1979. 3 tab, 23 ref.

Descriptors: *Bioassay, *Chlorine, *Freshwater fish, *Chloramines, Biocides, Toxicity, Mortality, Water temperature, Chlorination, Control, Shiners, Channel catfish, Suckers, Bass, Sunfishes, Carp, Fish physiology.

Ten riverine fish species were tested at 10, 20, and 30 C to determine their resistance to monochloramine. The exposure regime consisted of four 40-minute exposures administered at 5-hour intervals over 24 hours. All species exhibited an inverse relationship between temperature and medain lethal (LC50) concentrations. LC50 values generally decreased by a factor of two as the exposure temperature increased from 10 to 30 C. LC50 values ranged from 0.35 mg/liter at 30 C for the emerald shiner to 3.00 mg/liter at 10 C for the bluegill. Based on their resistance to monchloramine at 30 C the fish were separated into sensitive and resistant groups. The sensitive group, which included (in decreasing order of sensitivity) the emerals shiner (Notropis atherinoides), spotfin shiner (Notropis spilopterus), common shiner (Notropis cornutus), channel catfish (Ictalurus puncta-

tus), white sucker (Catastomus commersoni), and sauger (Stizostedion canadense), had LC50 values ranging from 0.35 to 0.71 mg/liter. The resistant group, freshwater drum (Aplodinotus grunniens), white bass (Morone chrysops), bluegill (Lepomis macrochirus), and carp (Cyprinus carpio) had LC50 values of 1.0-1.50 mg/liter. (Deal-EIS)
W79-08081

POLONIUM-210 AND LEAD-210 IN MARINE FOOD CHAINS,
International Lab. of Marine Radioactivity, Monte Carlo (Monaco). Oceanographic Museum.
M. Heyraud, and R. D. Cherry.
Marine Biology, Vol. 52, p 227-236, 1979. 2 fig, 7 tab, 25 ref.

Descriptors: *Lead radioisotopes, *Food chains, Lead, Metals, *Polonium, *Tissue analysis, *Bioaccumulation, *Tuna, Path of pollutants, Tracers, Radioactivity techniques, Radiation, Chemical analysis, Crustaceans, Mollusks, Shrimp, Fallout, Radiochemical analysis.

210Po and 210Pb have been measured systematically in whole animals, muscle and hepatopancreas of crustaceans and of molluscan cephalopods representative of a pelagic and benthic food chain. The same nuclides were also measured in liver, pyloric caecum, stomach contents and muscle of tuna. The concentration factors from sea water to whole animals were approximately constant along both food chains, being of the order of 10000 for 210Po and 100 for 210Pb. The highest concentration factors were found in shrimp of the genus Sergestes. In muscle, the concentration factors were an order of magnitude less; in the hepatopancreas, they were an order of magnitude higher, reaching 1,000,000 in shrimp of the genus Sergestes. Such concentrations imply alpha-radiation doses of the order of 10 rem per year and more in this organ, which contains about 50 to 90% of the 210Po in the whole animal in the 11 species analyzed. A detailed study of the intracellular behaviour of 210Po in the hepatopancreas is clearly indicated. 210Po can be used as a sensitive natural tracer in biological systems. Thus, feeding Meganyctiphanes norvegica in the laboratory on food low in 210Po led to an approximate value of about 6 1/2 days for the biological half-life of 210Po in the hepatopancreas of this euphausiid. Furthermore, the data on 210Po and 210Pb in the cephalopod hepatopancreas allowed the time of conservation of frozen squid which had been bought at the market to be estimated. (Deal-EIS)
W79-08082

INFLUENCE OF THREE SEDIMENT TYPES ON COPPER TOXICITY TO THE POLYCHAETE NEANTHES ARENACEODENTATA,
Environmental Research Lab. Narragansett, RI.
For primary bibliographic entry see Field 5C.
W79-08083

TRANSFER OF MERCURY FROM FISH CARCASS TO FORMICA AQUILONIA (HYMENOPTERA, FORMICIDAE),
Helsinki Univ. (Finland). Dept. of Environmental Conservation.
P. Nuorteva, H. Wuorenrinne, and M. Kaistila.
Annales Entemologici Fennici, Vol. 44, No. 3, p 85-86, 1978. 1 tab, 7 ref.

Descriptors: *Mercury, *Path of pollutants, *Insects, *Ants, *Bioaccumulation, *Tissue analysis, Chemical analysis, Heavy metals, Insect behavior, Food habits, Food chains, Scavengers, Animal populations.

A piece of mercury-contaminated fish (3.2 ppm) placed in a nest of Formica aquilonia Yarr. elevated the mercury content of the ants from 0.028 ppm to 0.163 ppm. When a similar piece of fish was placed at a distance of 5 m from a nest, the mercury content of the ants rose only slightly. No stabilization or decrease in mercury content was observerved during the test period. (Deal-EIS)
W79-08084

THE APPLICATION OF PLASTIC ENCLOSURES TO THE STUDY OF PELAGIC MARINE BIOTA,
Skidaway Inst. of Oceanography, Savannah, GA.
D. W. Menzel, and J. H. Steele.
Rapports Et Proces-Verbaux Des Reunions Conseil International Pour L'Exploration De La Mer, Vol. 173, p 7-12, 1978. 8 fig, 1 tab, 20 ref.

Descriptors: *Research equipment, *Pelagic biota, On-site data collections, On-site laboratories, On-site investigations, Analytical techniques, Aquatic populations, Phytoplankton, Trophic level, Zooplankton, Eutrophication, Water pollution effects, Biological communities.

Flexible plastic containers, ranging in volume from 1 to 2000 cubic meters, have been used to isolate water columns with their included organisms for biological-chemical studies of pelagic biota. Such containers have been applied to investigate phytoplankton dynamics, natural cycles in mixed trophic level ecosystems, and the effects of eutrophication and pollutants. They are in a sense analogous to controlled experimental plots used in agricultural research and perhaps are the best approach currently available to study the same pelagic populations over extended periods of time. The ability of the containers to support 'higher' trophic level organisms is directly related to the size of the enclosure. The 'optimum' practical volume of containers for mixed trophic level studies is most likely between 1000 and 2000 cubic meters when the column depth is 1.5 times that of the euphotic zone. The physical dimensions of any container, however, cannot be made large enough to examine phyto-zooplankton interactions in both spatial and temporal dimensions which characterize natural distributions in the ocean. Their utility is largely in studying interactions and rate processes over time. (Deal-EIS)
W79-08085

INFLUENCES OF SELECTED ENVIRONMENTAL FACTORS ON THE ACTIVITY OF A PROSPECTIVE FISH TOXICANT, 2-(DIGERANYLAMINO)-ETHANOL, IN LABORATORY TESTS,
National Fishery Research Lab., LaCrosse, WI.
C. A. Launer, and T. D. Bills.
Investigations in Fish Control, Report No. 88, 1979. 4 p, 5 tab, 9 ref.

Descriptors: *Toxicity, *Pesticides, *Fish phsysiology, *Elodea, *Lemna, Fish control agents, Minnows, Brown trout, Rainbow trout, Water temperature, Hydrogen ion concentration, Turbidity, Ultraviolet radiation, Vegetation effects, Acidic water, Water chemistry, Chemical properties.

Fathead minnows, brown trout, and rainbow trout were used to assess the influences of temperature, pH, turbidity, ultraviolet light, and aquatic vegetation on the toxicity of an experimental fish toxicant, 2-(digeranylamino)-ethanol (GD-174). Also examined was the feasibility of chemical counteraction by oxidation or reduction. The activity of the compound was reduced in cold water, in acid water, and in turbid water where the turbidities were produced by bentonite or Crowley silt loam, and in water containing waterweed (Elodea sp.). The activity was not affected by exposure to ultraviolet light, by the presence of duckweed (Lemna sp.) or by turbidities produced by kaolin or barium sulfate. GD-174 can be counteracted by either oxidation or reduction; oxidation by potassium permanganate was the most effective procedure tested. (Deal-EIS)
W79-08087

THE IMPACT OF OIL POLLUTION ON INTERTIDAL MEIOFAUNA. FIELD STUDIES AFTER THE LA CORUNA-SPILL, MAY 1976,
Hamburg Univ. (Germany, F.R.). Museum of Zoology.
O. Giere.
Cahiers de Biologie Marine, Vol. 20, p 231-251, 1979. 5 fig, 1 tab, 52 ref.

Descriptors: *Oil spills, *Toxicity, *Intertidal areas, *Meiofauna, *Crude oil, *Spain, *Species diversity, Biological communities, Oil, Oil pollution, Organic compounds, Nematodes, Annelids, Coasts, Beaches, Dominant organisms, Habitats, La Coruna.

The effect of oil contamination by the spill from the super-tanker 'Monte Urquiola' on the intertidal meiofauna was studied shortly after the accident and also one year later. The investigated sites along the northern Spanish coast covered an area from heavily polluted shores to beaches without visual oil contamination. The impact on the meiofauna could be related to the exposure of the sampling stations to the center of the spill and affected the various taxonomical groups differently, many nematodes and annelids being relatively resistant, harpacticoids and turbellarians more sensitive. Within one year, the meiofauna had recovered considerably with regard to diversity and abundance, both of which had been heavily suppressed shortly after the spill. The reasons for this relatively quick reappearance and the different reactions of interstitial fauna to oil contamination are discussed in relation to the specific habitat properties in the area. (Deal-EIS)
W79-08089

SOURCES OF POLLUTION FROM AGRICULTURAL DRAINAGE,
California Regional Water Quality Control Board, Sacramento. Central Valley Region.
For primary bibliographic entry see Field 5B.
W79-08094

A STATISTICAL MODEL FOR PREDICTING CHLOROFORM LEVELS IN CHLORINATED SURFACE WATER SUPPLIES,
Massachusetts Univ., Amherst.
G. S. Moore, R. W. Tuthill, and D. W. Polakoff.
Journal of the American Water Works Association, Vol. 71, No. 1, p 37-39, January 1979. 2 tab, 1 fig, 7 ref.

Descriptors: *Statistical models, *Regression analysis, *Water quality, *Chloroform levels, *Chlorinated water, *Water supply, Surface waters, Raw water, Treated water, Systems analysis, Massachusetts, Prediction.

Multiple regression analysis of a number of routinely measured characteristics--temperature, turbidity, color, pH free residual chlorine, total residual chlorine, and chloroform--of the raw water, finished plant water, and distribution system water of nineteen Massachusetts communities showed chlorine dosage to be the most reliable predictor of chloroform levels in the water supply. A set of Pearson product moment correlations were computed between each of the water characteristics and the distribution system chloroform levels. (Bell-Graf--Cornell)
W79-08212

METHOD AND APPARATUS FOR ANALYSIS OF WATER,
Commonwealth Scientific and Industrial Research Organization, Campbell (Australia). (Assignee).
V. A. Garten, R. McNeill, J. M. Overbeek, and R. B. Head.
U.S. Patent No. 4,140,487, 10 p, 5 fig, 1 tab, 3 ref; Official Gazette of the United States Patent Office, Vol. 979, No. 3, p 993, February 20, 1979.

Descriptors: *Patents, *Pollutant identification, *Water pollution, Water quality control, Analytical techniques, Organic matter, Inorganic compounds, Ozone, Light, Equipment.

A method is presented for detecting the presence in water of substances which are rapidly oxidized by ozone with the emission of quanta of visible light. The method comprises contacting the water with ozone and detecting the light quanta emitted. Water which contains any organic substances having SH groups (present in almost all proteins), phenolic OH groups and olefinic double bonds and/or inorganic sulphides and/or ammonia will, on reaction with ozone, produce visible light quanta. The apparatus for carrying out the method of the invention comprises a reaction vessel to

contain a body of water, means for generating and supplying ozone to water in the vessel, means for introducing a test sample of water into the vessel, and means for detecting light emitted from the water. (Sinha-OEIS)
W79-08221

A NATIONAL SURVEY FOR CADMIUM, CHROMIUM, COPPER, LEAD, ZINC, CALCIUM, AND MAGNESIUM IN CANADIAN DRINKING WATER SUPPLIES,
Environmental Health Center, Ottawa (Ontario).
J. C. Meranger, K. S. Subramanian, and C. Chalifoux.
Environmental Science and Technology, Vol. 13, No. 6, p 707-711, June 1979. 6 tab, 20 ref.

Descriptors: *Metals, *Trace elements, *Water supplies, *Canada, Heavy metals, Surveys, Sampling, Chemical analysis, Spectrophotometry, Cadmium, Chromium, Copper, Lead, Zinc, Calcium, Magnesium, Hardness(Water), Potable water, Pollutants, Pollutant identification, Water quality, *Newfoundland, *Manitoba.

A national survey was conducted to determine the levels of Cd, Cr, Cu, Pb, Zn, Ca, and Mg in Canadian drinking water supplies. Samples of raw, treated, and distributed water, obtained from 70 municipalities across Canada, were analyzed by atomic absorption spectrometry. The concentrations of trace metals found were essentially the same for all 3 types of water samples. The median and range values for distributed water expressed as ng of metal/mL of water were found to be: Cd less than 0.01 (less than 0.01-0.49); Cr less than 2.0 (less than 2.0-8.0); Cu, 20 (5.0-620); Pb less than 1.0 (less than 1.0-65.0); Zn, 10 (less than 5.0-380). Values for water hardness, expressed as mg of CaCO3/L, ranged from 1 in St. John's, Newfoundland, to 554 in Selkirk, Manitoba. Contamination of the water supplies with these metals, except copper, was minimal during treatment and distribution. In all cases, the median values for the distributed water were well below the WHO upper limit recommendations. (Sims-ISWS)
W79-08258

PARTICULATE ZINC, CADMIUM, LEAD, AND COPPER IN THE SURFACE MICROLAYER OF SOUTHERN LAKE MICHIGAN,
Clemson Univ., SC. Dept. of Environmental Systems Engineering.
A. W. Elzerman, D. E. Armstrong, and A. W. Andren.
Environmental Science and Technology, Vol. 13, No. 6, p 720-725, June 1979. 3 fig, 5 tab, 35 ref.

Descriptors: *Metals, *Trace elements, *Sampling, *Lake Michigan, *Great Lakes, Chemical analysis, Filtration, Surveys, Chemicals, Heavy metals, Zinc, Cadmium, Lead, Copper, Pollutants, Pollutant identification, Water quality, Particulate matter, Surface layers.

Particulate matter of diverse composition and morphology commonly occurred in higher concentrations in screen-collected surface microlayer (SM) samples than in the bulk water of southern Lake Michigan. Filtration experiments (0.4 micrometer Nuclepore) indicated that enrichment of Zn, Cd, Pb, and Cu in the SM occurred substantially in the particulate phase, especially when surface enrichments were large. Surface enrichment of total particulate matter and Zn, Cd, Pb, and Cu was related to the presence of surface accumulated material and film pressure. Chemical analysis indicated that a significant portion of the particulate Zn, Cd, Pb, and Cu in the SM may be atmospherically transported anthropogenic particulate matter. (Sims-ISWS)
W79-08259

AUTOMATED CHEMICAL ANALYSIS FOR MEASURING MICROGRAM LEVELS OF ORGANIC CARBON IN POTABLE WATERS,
National Inst. for Water Research, Pretoria (South Africa).
R. A. van Steenderen, W. D. Basson, and F. A. van Duuren.
Water Research, Vol. 13, No. 6, p 539-543, 1979. 4 fig, 1 tab, 6 ref.

Descriptors: *Chemical analysis, *Automation, *Carbon, *Potable water, Organic compounds, Equipment, Instrumentation, Chemicals, Measurement, Sampling, Chemistry, Water chemistry, Pollutants, Pollutant identification, Water pollution, Water quality.

An automated method for the direct determination of microgram levels of organic carbon in potable waters was described. The technique is that of continuous flow analysis and utilizes an automatic sampler, a multiple channel proportioning pump, and an appropriate analytical system (manifold). Samples are acidified, oxygen segmented, and passed through a heated inorganic carbon removal was not possible. The stripped liquid was re-sampled, mixed with silver peroxydisulphate solution, and digested at 70 C. The liberated CO2 was measured by means of infrared photometry. Complete inorganic carbon removal was not possible. From a 30 mg/cu dm inorganic carbon solution, 0.1% residual remained after stripping. Using a sample volume of 6.3 cu cm/min full-scale recorder deflection could be obtained for a 1 mg/cu dm organic carbon standard solution with a relative standard deviation of 0.9%. The lower detection limit of practical significance is 50 microgram/cu dm organic carbon. The analysis rate was 20 samples per hour. Certain synthetic organic materials resisted complete oxidation and included the amino acids glycine, 1-alanine, leucine, iso-leucine and valine. (Sims-ISWS)
W79-08260

DETERMINATION OF HEAVY METALS AND SELENIUM IN FISH FROM UPPER AUSTRIAN WATERS -- PART 2: LEAD, CADMIUM, SCANDIUM, CHROMIUM, COBALT, IRON, ZINC AND SELENIUM (IN GERMAN),
Oesterreichische Studiengesellschaft fuer Atomenergie G.m.b.H., Seibersdorf. Inst. fuer Biologie.
D. K. Teherani, G. Shehlik, N. Tehrani, H. Schada, and J. Hinteregger.
Environmental Pollution, Vol. 18, p 241-248, 1979. 1 tab, 1 app, 9 ref. (English Abstract).

Descriptors: *Heavy metals, *Fish populations, *Path of pollutants, *Tissue analysis, *Bioaccumulation, *Scandium, *Selenium, *Austria, Lead, Cadmium, Chromium, Cobalt, Iron, Zinc, Chemical analysis, Fish physiology, Neutron activation analysis.

119 samples of fish caught in September 1974 in Upper Austrian waters were analyzed for zinc, iron, cobalt, chromium, scandium and selenium by neutron activation analyses and for lead and cadmium by atomic absorption spectrometry. The concentration values found for Zn ranged between 13 and 44 ppm, for Fe between 11 and 111 ppm, for Co between 0.01 and 0.40 ppm, for Cr between 0.02 and 0.21 ppm, for Pb between 0.01 and 0.13 ppm with a single exception, for Cd between 0.01 and 0.13 ppm and for Se between 0.62 and 2.02 ppm. The concentration of Sc was below the detection limit (0.5 pptm) for all fish samples analysed. (Deal-EIS)
W79-08276

EFFECTS OF ORAL ADMINISTRATION OF CADMIUM ON FISH - IV EFFECTS ON ULTRASTRUCTURES OF HEPATIC AND RENAL CELLS OF THE CARP AND THE PORGY,
Kyushu Univ., Fukuoka (Japan). Dept. of Fisheries.
J. Koyama, M. Fujita, and Y. Itazawa.
Bulletin of the Japanese Society of Scientific Fisheries, Vol. 45, No. 4, p 429-436, 1979. 4 pl. 15 ref.

Descriptors: *Cadmium, *Carp, *Toxicity, *Porgy, Fish physiology, Cytological studies, Electron microscopy, Path of pollutants, Heavy metals, Animal pathology, Chemical analysis, Mode of action, Water pollution effects.

Carp (Cyprinus carpio) were fed for 30 days (0, 140 and 1700 ppm) or 14 days (5700 ppm) on feed containing Cd of 0, 140, 1700 or 5700 ppm in the dry weight. Porgy (Pagrus major) were fed for 113 days on feed containing Cd of 0, 37.5, 150 or 375 ppm in the dry weight. In the hepatic cells of both fishes fed on Cd-containing feed the most remarkable alterations were increase and enlargement of lysosomes with the increase of Cd content in feed. Decrease of glycogen granules (carp and porgy), increase and dilation of smooth-surfaced endoplasmic reticulum (carp), and increase of rough-surfaced endoplasmic reticulum (porgy) were noticed in the hepatic cells of Cd-administered fish. In the epithelial cells of the proximal segment of renal tubule of both fishes fed on Cd-containing feed the most remarkable alterations were increase and enlargement and losomes and apical vacuoles, increase of coated vesicles and apical tubules, and dilation of smooth-surfaced endoplasmic reticulum. These ultrastructural alterations in the liver and kidney are considered to be the effects of ingested Cd, and to imply functional disorders of both organs. (Deal-EIS)
W79-08277

MORTALITY OF EXPERIMENTALLY DESCALED SMOLTS OF COHO SALMON (ONCORHYNCHUS KISUTCH) IN FRESH AND SALT WATER,
Fish and Wildlife Service Seattle, WA.
For primary bibliographic entry see Field 5C.
W79-08279

MODEL OF RAPID DETECTION OF SUBLETHAL EFFECTS OF POLLUTANTS: MODIFICATION OF AMYLASE AND TRYPSIN LEVELS OF ARTEMIA SALINA CONTAMINATED BY COPPER OR ZINC, (IN FRENCH),
Centre National pour l'Exploitation des Oceans, Paris (France); and Centre Oceanologique de Bretagne, Brest (France).
A. M. Alayse-Danet, J. L. Charlou, M. Jezequel, and J. F. Samain.
Marine Biology, Vol. 51, p 41-46, 1979. 3 fig, 24 ref. (English Abstract).

Descriptors: *Enzymes, *Brine shrimp, *Inhibition, *Amylase, *Trypsin, *Tissue analysis, Growth rates, Animal metabolism, Animal physiology, Copper, Zinc, Water pollution effects, Bioindicators, Chemical analysis, Metals.

Variations in amylase and trypsin activities were studied in Artemia salina L. exposed to concentrations of copper or zinc which impair their growth. Disturbances in the levels of these enzymes were compared with decreases in growth rate. Amylase activity was disturbed within 24 h by 2 ppm copper and within 72 h by 5 ppm zinc. Inversely, trypsin activity was disturbed within 24 h by 5 ppm zinc and within 72 h by 2 ppm copper. Disturbances at the enzymatic level occurred more rapidly than decreases in growth rate, except for trypsin in A. salina polluted by copper. In the latter case, both were affected simultaneously. The possibility of growth disturbance by modified development of digestive enzymes is discussed. The possible use of enzymatic variation for rapid detection of sublethal effects of pollutants on aquatic organisms in situ is suggested. (Deal-EIS)
W79-08280

ECOLOGOBIOCHEMICAL CHARACTERISTICS OF HYDROCARBONS IN SOME MEDITERRANEAN SEA ORGANISMS,
Institute of Biology of Southern Seas, Sevastopol, (USSR).
T. L. Shchekaturina.
Hydrobiological Journal, Vol. 14, p 81-84, 1978. 1 fig, 1 tab, 12 ref. (Translated from Russian).

Descriptors: *Oil, *Oil pollution, Oil spills, *Monitoring, Chemical analysis, Benthos, Petroleum hydrocarbons, Mediterranean Sea, Sediments, *Molluscs, Mussels, Clams, Sea urchins, Normal alkanes, Chromatograms, Branched alkanes, Paraffinic hydrocarbons, Naphthenic hydrocarbons.

The qualitative and quantitative composition of some Mediterranean Sea organisms is investigated. The concentration of saturated hydrocarbons varies from 0.01 to 2 mg/100 g of wet weight.

With n-alkanes from C11 up to C19 and branched alkanes from iC14 to iC20 it is apparent that hydrocarbons of both artificial and natural origin are present. Aquatic organisms may be used as indicators of water pollution. (Katz-EIS)
W79-08282

USE OF MACROINVERTEBRATE LIFE HISTORY INFORMATION IN TOXICITY TESTS,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Biology.
A. L. Buikema, Jr., and E. F. Benfield.
Journal of the Fisheries Research Board of Canada, Vol. 36, p 321-328, 1979. 68 ref.

Descriptors: *Methodology, Review, *Bioassays, *Toxicity, Benthos, Benthic fauna, Life history studies, Aquaculture, Laboratory tests, Animal physiology, Fish culture, Nutrient requirements, Animal behavior, Experimental design, *Invertebrates.

Life history information of macroinvertebrates is an important variable to consider when interpreting the results of toxicity tests. The importance of life history information has been recognized in the culturing of macroinvertebrates, but only in the last 5 yr has emphasis been placed on using this information in the design of acute and chronic toxicity tests. Sensitivity of organisms to toxicants is affected by nutrition, physiological requirements, behavior, predator-prey interactions, substrate, current, and light. There is need to integrate these, and other variables, to produce more defensible tests. Some features of life history may be used as end points in tests. (Katz-EIS)
W79-08285

SAMPLING STRATEGIES AND LIFE HISTORY OF NON-INSECTAN FRESHWATER INVERTEBRATES,
Fisheries and Marine Service, Winnipeg (Manitoba). Freshwater Inst.
D. F. Malley, and J. B. Reynolds.
Journal of the Fisheries Research Board of Canada, Vol. 36, p 311-318, 1979. 1 tab, 46 ref.

Descriptors: *Methodology, *Benthos, Benthic fauna, *Invertebrates, Freshwater, Life cycles, Life history studies, Non-insect invertebrates, Crayfish, Opposum shrimp, Mysis, Oronectes, Juvenile growth stages, Sampling, Monitoring.

Life history of benthic freshwater invertebrates, excluding insects, may influence a number of features of sampling programs, such as the environment sampled, sampling technique or equipment used, frequency and timing of sampling, and mesh sizes of nets or sieves. Consideration of the life history should increase the effectiveness of the program and, in the extreme, may allow one to recognize artifacts that would otherwise lead to incorrect conclusions. Aspects of life history that influence sampling programs are (1) direct or indirect embyronic development and the extent to which young are sampled simultaneously with adults during the breeding season, (2) times of year when various developmental stages are present, (3) differences in size between various life stages necessitating use of more than one sampling method during the year, (4) change in habitat due to migrations or assumption of a pelagic, parasitic, or aerial existence for part of the life cycle, (5) change in mobility over the life cycle, (6) sex differences in size or behavior, and (7) adaptations to adverse conditions. Examples of ways in which life history affects sampling are based on the literature and on original data on the opposum shrimp, Mysis relicta, and the crayfish, Orconectes virilis. (KatZ-EIS)
W79-08286

IODINE BALANCE IN RAINBOW TROUT (SALMO GAIRDNERI) AND EFFECTS OF TESTOSTERONE PROPIONATE,
Manitoba Univ., Winnipeg. Dept. of Zoology.
D. W. C. Hunt, and J. G. Eales.
Journal of the Fisheries Research Board of Canada, Vol. 36, p 282-285, 1979. 1 fig, 2 tab, 21 ref.

Descriptors: *Iodine, *Iodine balance, Rainbow trout, Animal physiology, Animal biochemistry, Iodide, Iodide flux, Fish foods, *Path of pollutants, Fish diets, Fish farming, Laboratory tests, Water pollution effects, Testosterone, Hormones.

Iodine balance was studied in immature rainbow trout held at 12 degrees C in water of iodine content 1.85 microgram/L and fed daily 1% of body weight with food containing 0.48 microgram I/g. Iodide flux into the plasma pool was 148 nanograms 1 per hour 100 grams of which < 1% was contributed by peripheral deiodination of thyroid hormones, up to 16% was obtained from the diet, and at least 84% was derived from the water. Less than 5% of iodide intake was required to satisfy thyroidal secretory demands. Testosterone injections elevated plasma iodide and protein levels, but did not alter the rate of plasma iodide turnover. (Katz-EIS)
W79-08287

THE DOMINANCE OF NANOPLANKTON AS AN INDICATOR OF MARINE POLLUTION: A CRITIQUE,
California Univ., San Diego. La Jolla. Inst. of Marine Resources.
R. W. Eppley, and C. S. Weiler.
Oceanologica Acta, Vol. 2, No. 2, p 241-245, 1979. 48 ref.

Descriptors: *Nanoplankton, *Dominant organisms, *Marine microorganisms, Phytoplankton, Eutrophication, Spatial distribution, Zooplankton, Food webs, Bioindicators, Trophic level, Ecosystems, Monitoring.

This is a brief review of the possible relationship between small-celled flagellated and coccoid phytoplankton and pollution. Examples are presented of the abundance of these forms in both pristine and polluted or eutrophied areas of the ocean. The natural distribution of these organisms is influenced also by water circulation patterns and food web interactions, including the grazing upon them by microzooplankton. Their dominance in the ocean at particular times and places cannot be inferred to reflect a result of pollution without other supporting evidence. (Deal-EIS)
W79-08288

MERCURY POLLUTION OF THE MARINE ENVIRONMENT IN THE REGION OF MARSEILLE, MEDITERRANEAN, FRANCE. PART 3-DEGREE OF CONTAMINATION BY MERCURY OF THE ECHINODERMS LIVING IN THE KELP BEDS IN THE VICINITY OF THE LARGE SEWER OF THE CITY OF MARSEILLES, (IN FRENCH),
Aix-Marseille-2 Univ. (France). Sciences de la Mer et de l'Environment.
H. Augier, G. Gilles, and G. Ramonda.
Environmental Pollution, Vol. 18, p 179-185, 1979. 1 fig, 3 tab, 12 ref, (English summary).

Descriptors: *Mercury, *Tissue analysis, *Bioaccumulation, *Sea urchins, *France, Spectrophotometry, Chemical analysis, Chemical wastes, Animal metabolism, Industrial wastes, Heavy metals, Water pollution sources, Path of pollutants, Sea cucumbers.

Flameless atomic absorption spectrophotometry has been used to measure concentrations of mercury in Holothuria forskali and the sea-urchins Sphaerochinus granularis and Paracentrotus lividus in relation to depths of collection, size and the degree of pollution. The ranges of mercury (ppm) were 0.16-2.90 for H. forskali, 0.10-0.60 for P. lividus and 0.14-0.73 for S. granularis. The results show that the highest levels occur near the city of Marseilles adjacent to the main sewer. (Deal-EIS)
W79-08290

MEDICATION INHIBITS TOLERANCE TO SEAWATER IN COHO SALMON SMOLTS,
Fish & Wildlife Service, Seattle, WA.
For primary bibliographic entry see Field 5C.
W79-08295

RELEASE OF TRACE METALS BY SEWAGE SLUDGE AND THE SUBSEQUENT UPTAKE BY MEMBERS OF A TURTLE GRASS MANGROVE ECOSYSTEM,
Harbor Branch Foundation, Inc. Fort Pierce, FL.
J. R. Montgomery, and M. T. Price.
Environmental Science & Technology, Vol. 13, p 546-549, 1979. 2 fig, 3 tab, 13 ref.

Descriptors: Metals, *Cadmium, *Chromium, *Copper, *Nickel, *Lead, *Zinc, Laboratory tests, Marine algae, Sea urchin, Waste disposal, Sewage disposal, Sewage sludge, Turtle grass, *Mangrove ecosystem, Water pollution effects, Path of pollutants, Red mangrove, Clams, Oyster, Snails, Tidal marshes, Tropical regions.

This research was initiated to determine the rates of uptake, by a Thalassia testudinum mangrove ecosystem, over a 125-day period, of Cd, Cr, Cu, Ni, Pb, and Zn. The metals were leached from sewage sludge by flowing seawater (8.4 L/min) and subsequently traversed the model system. The largest net uptake of metals occurred in the 'fouling organisms' where Cd, Pb, and Zn uptake closely paralleled the net loss of metals from the sewage sludge. Thalassia leaves showed a net uptake for Cr, Pb, Ni, and Zn. The urchin Lytechnius variegatus, a grazer of Thalassia lves, also demonstrated a net uptake of Cu, Cr, Pb, Zn, and Ni. The sea cucumber Holothuria mexicana showed a net uptake of Cr, Cu, Pb, and Zn. Net uptake of metals was shown by the roots of the red mangrove Rhizophora mangle Linne. Because of insufficient sample mass, no consistent metal uptake was found for the clam Codakia orbicularis, oyster Crassostrea rhizophorae, or the snail Nerita tessellata. The results indicate that the dumping of sewage sludge in coastal tropical waters can lead to the uptake and concentration of toxic trace metals by members of a turtle grass community. (Katz-EIS)
W79-08296

ADSORPTION OF POLYCHLORINATED BIPHENYL ONTO SEA BED SEDIMENT, MARINE PLANKTON, AND OTHER ADSORBING AGENTS,
Tokyo Univ. (Japan). Dept. of Chemical Engineering.
For primary bibliographic entry see Field 5C.
W79-08297

DEGRADATION OF DIAZINON BY SODIUM HYPOCHLORITE. CHEMISTRY AND AQUATIC TOXICITY,
Army Medical Bioengineering Research and Development Lab. Fort Detrick, MD.
W. H. Dennis, Jr., E. P. Meier, W. F. Randall, A. B. Rosencrance, and D. H. Rosenblatt.
Environmental Science & Technology, Vol. 13, p 594-598, 1979. 113 ref.

Descriptors: *Toxicity, *Bioassay, Laboratory tests, Pesticides, *Insecticides, Waste disposal, Waste treatment, Degradation(Decomposition), Sunfish, Freshwater fish, Chlorinated aromatic hydrocarbons, Aromatic naphtha, Chemical disposal systems, *Diazinon, Minnows, Daphnia, Freshwater fish, Chemical analysis, Chemical reactions, Chemical wastes.

This study demonstrated that diazinon is rapidly degraded by sodium hypochlorite between pH 8 and 10. The sequence of reaction was determined and the two principal end products of the reaction were identified as acetic acid and isobutyramidinium trichloroacetate. Treatment with hypochlorite reduced the acute toxicity of diazinon dust formulations to bluegill by at least 3700-fold. Bioassay data indicated that a diazinon emulsifiable concentrate formulation retained considerable toxicity after treatment with sodium hypochlorite. The toxic components of the emulsifiable concentrate reaction mixture were identified as the heavy aromatic naphtha constituent of the formulation and the chlorinated aromatic hydrocarbons produced by the hypochlorite reaction. These components were almost as toxic as the diazinon formulation. A model approach emphasizing the need for bioassay data in development of chemical disposal systems is proposed and discussed. (Katz-EIS)

W79-08298

THE IMPORTANCE OF SALINITY IN DETERMINING THE MORPHOLOGY AND COMPOSITION OF ALGAL MATS,
North Carolina Univ. at Chapel Hill. Curriculum in Marine Sciences.
J. G. Sanders.
Botanica Marina, Vol. 22, p 159-162, 1979. 1 fig, 2 tab, 2 ref.

Descriptors: *Salinity, *Marine algae, North Carolina, Shackleford banks, Algae, *Plant groupings, Plant growth, Plant populations, Bioassays, Laboratory tests, Bluegreen algae, Green algae, Lyngbya, Algal composition, *Algal mat growth, Intertidal areas, Supertidal areas.

Three algal mats on Shackleford Banks, North Carolina, have different algal assemblages due to salinity differences in the underlying water table. Intertidal, saline mats are dominated by one species of Lyngbya, while supertidal mats are dominated by a mixture of blue-green and green algae. The salinity stress also effectively reduces species diversity in the intertidal mat; however, the daily tidal flushing of the mat allows more active growth. In laboratory experiments it was demonstrated that the intertidal mat grew best at 20% salinity and the supertidal mat grew best at 0% salinity. (Katz-EIS)
W79-08299

THE ROLE OF EFFLUENT MONITORING IN ENVIRONMENTAL CONTROL,
British Columbia Univ., Vancouver. Faculty of Commerce and Business Administration.
P. N. Nemetz, and H. D. Drechsler.
Water, Air and Soil Pollution, Vol. 10, p 477-497, 1978. 5 fig, 9 tab, 9 ref.

Descriptors: *Monitoring, Water pollution effects, Industrial wastes, Industrial plants, British Columbia, *Pulp wastes, Pulp and paper industry, Environmental control, Environmental engineering, Sampling, Composite sampling, Systems, *Monitoring practices.

Using effluent data from a British Columbia pulp mill, the authors demonstrate certain critical deficiencies associated with currently emplaced monitoring systems. The principal ingredient in effective environmental control is information, and current monitoring regimes entail an unacceptable level of information loss. Composite sampling systems fail to provide the two key types of information required for effective environmental control; (1) a high representational accuracy of the effluent profile; and (2) the detection of most or all pollutant releases with potentially serious environmental consequences. In light of these conclusions, the authors make several recommendations concerning current and alternative sampling regimes. (Katz-EIS)
W79-08307

HEAVY METALS IN RELATION TO THE BIOLOGY OF THE MUMMICHOG, FUNDULUS HETEROCLITUS,
Adelphi Univ., Garden City, NY. Dept. of Biology.
B. Chernoff, and J. K. Dooley.
Journal of Fish Biology, Vol. 14, p 309-328, 1979. 10 fig, 5 tab, 55 ref.

Descriptors: *Metals, *Cadmium, *Copper, *Mercury, *Manganese, *Zinc, Water pollution effects, Path of pollutants, Water chemistry, Tissue concentrations, Mummichog, Fundulus heteroclitus, Sex differences, Long Island, Long Island Sound, Great South Bay, Hempstead Harbor, Jamaica Bay, Bioconcentration.

Heavy metal levels of cadmium, copper, mercury, manganese, and zinc were examined in the mummichog, Fundulus heteroclitus, from industrialized and non-industrialized environments. With one exception, the environment with the highest trace metal in its waters, had the fishes with the highest metal concentration. Except for mercury the concentration factor varied inversely with the metal concentrations of the fish and water, suggesting a possible regulatory mechanism for metals in the tissues of mummichogs from environments with high metal concentrations. There was an inverse relationship between standard length and concentrations of zinc, manganese, copper and cadmium in whole male and female fishes. The viscera contained significantly greater concentrations of these metals than somatic muscle tissue. There were also significant differences between males and females with respect to whole-body zinc and copper concentrations, but no sex differences for manganese and cadmium. (Katz-EIS)
W79-08308

STRONTIUM MARKING OF HATCHERY-REARED COHO SALMON (ONCORHYNCHUS KISUTCH, WALBAUM),
Fisheries and Marine Service, Nanaimo (British Columbia). Pacific Biological Station.
S. B. Yamada, T. J. Mulligan, and S. J. Fairchild.
Journal of Fish Biology, Vol. 14, p 267-275, 1979. 1 fig, 5 tab, 6 ref.

Descriptors: *Salmon, Coho salmon, *Fish management, Fish hatcheries, Fish population, *Fish foods, *Strontium, *Calcium, Path of pollutants, Water pollution effects, Juvenile fish, Growth, Fisheries, *Fish marking, Fish identification.

This study examines the feasibility of marking fish tissue by substituting a biologically rare element, strontium, for calcium. Sixteen-month-old hatchery-reared coho salmon (Oncorhynchus kisutch) were fed a diet, to which 10,000 ppm stable strontium was added, for 60 days. Prior to their seaward migration in June 1976, the treated coho contained 32 times as much strontium in their vertebrae as did the control coho. Sixty-eight precocious males 'jacks' returned to the hatchery in the fall of 1976 and 1200 adults in the fall of 1977. Strontium-treated 'jacks' contained 1.4 times as much strontium as did control 'jacks' however, treated and untreated fish could not be distinguished as adults. The reduction in the strontium concentration of the treated fish could be accounted for by growth. (Katz-EIS)
W79-08310

A NOVEL BIOPSY TECHNIQUE FOR MONITORING ENVIRONMENTAL CONTAMINANTS IN FISH,
Queensland Dept. of Primary Industries, Brisbane (Australia).
D. C. Moy, and M. C. L. Dredge.
Bulletin of Environmental Contamination and Toxicology, Vol. 22, p 35-37, 1979. 4 ref.

Descriptors: *Analytical techniques, *Mullets, *Biopsy, *Tissue analysis, Tagging, Marking techniques, Non-destructive tests, Research and development, Testing procedures, Mortality, Laboratory tests, On-site collections.

One of the major problems in detecting and monitoring pollutant chemicals in living organisms is the normally destructive nature of the sampling and testing. A needle biopsy and tagging technique is described. The technique requires three individuals to perform and takes 30 seconds per fish. No mortalities secondary to the procedure were observed in 30 fish during an aquarium trial. Work is continuing on the analytical methodology necessary to use the biopsy samples for pesticide monitoring. (Deal-EIS)
W79-08311

EFFECTS OF THE WATER-SOLUBLE FRACTION OF COOK INLET CRUDE OIL ON THE MARINE ALGA, DUNALLIELA TERIOLECTA,
California Univ., Bodega Bay. Bodega Marine Lab.
P. Nunes, and P. E. Benville, Jr.
Bulletin of Environmental Contamination and Toxicology, Vol. 21, p 727-732, 1979. 2 fig, 1 tab, 8 ref.

Descriptors: *Growth rates, *Oil, *Toxicity, *Marine algae, *Crude oil, *Dunalliela, Oil spills, Oil pollution, Organic compounds, Phytoplankton, Bioassay, Gas chromatography, Chemical analysis, Microbial degradation, Cook Inlet crude oil, Water soluble fraction.

Previous oil bioassays on phytoplankton report the combined effects of oil and oil dispersing agents. This study attempts to determine the effects of the water-soluble components of Cook Inlet crude oil on the marine alga, Dunalliela tertiolecta, without the addition of emulsifying agents. The results of this study indicate that low concentrations of the water-soluble fraction of crude oil have a stimulatory effect on the growth rate of this marine alga. (Deal-EIS)
W79-08313

UPTAKE AND DEPURATION OF PETROLEUM HYDROCARBONS IN THE MANILA CLAM, TAPES SEMIDECUSSATA REEVE,
California Univ., Bodega Bay. Bodega Marine Lab.
P. Nunes, and P. E. Benville, Jr.
Bulletin of Environmental Contamination and Toxicology, Vol. 21, p 719-726, 1979. 1 fig, 1 tab, 19 ref.

Descriptors: *Clams, *Oil, *Animal metabolism, *Absorption, *Crude oil, *Tissue analysis, *Bioaccumulation, *Depuration, *Tapes, Chemical analysis, Organic compounds, Aromatic compounds, Water chemistry, Path of pollutants, Animal physiology, Commercial shellfish, Bioassay, Benzene, Toluene, Ethylbenzene, P-xylene, M-xylene, O-xylene.

Clams were exposed to a continuous-flow of the water-soluble fraction of Cook Inlet crude oil for eight days and the water and clam tissues analyzed for six monocyclic aromatics, namely, benzene, toluene, ethylbenzene, P-xylene, M-xylene, and O-xylene. Five of the monocyclics were found in the water and four of the monocyclics were found to have been accumulated by the clams. Benzene concentration was the highest in the water phase followed by toluene, M-xylene, O-xylene and ethylbenzene. The same order of concentration was observed in clam tissues except for benzene which our analytical method was unable to detect during uptake and depuration. (Deal-EIS)
W79-08314

THE IN VIVO EFFECT OF MERCURIC CHLORIDE ON SOME DIGESTIVE ENZYMES OF A FRESH WATER TELEOST FISH, CHANNA PUNCTATUS,
D.A.V. Coll., Muzaffarnagar (India). Dept. of Zoology.
K. V. Sastry, and P. K. Gupta.
Bulletin of Environmental Contamination and Toxicology, Vol. 22, p 9-16, 1979. 2 tab, 29 ref.

Descriptors: *Enzymes, *Mercury, *Toxicity, *Channa, *Tissue analysis, Heavy metals, Chemical analysis, Path of pollutants, Chlorides, Digestion, Fish physiology, Animal metabolism, Inhibition, Biochemistry, Phosphatase.

Alterations in the activities of alkaline phosphatase, acid phosphatase, glucose-6-phosphatase amylase, trypsin, pepsin, aminotripeptidase, glycylglycine dipeptidase and carnosinase due to exposure of Channa punctatus to a sublethal concentration (0.30 mg/L) of mercuric chloride by bath for 20 days have been studied in the different parts of the digestive system. A fall in the activities of the three phosphatases was recorded except for alkaline phosphatase which showed a slight elevation in activity in intestine and pyloric caeca. An increase in the activity of amylase and the two proteases was observed in all the portions of the digestive system. The three peptidases revealed a decrease in activity. (Deal-EIS)
W79-08317

EFFECTS OF CALCIUM ADDITION AS CA(NO3)2 ON ZINC TOXICITY TO FATHEAD MINNOWS, PIMEPHALES PROMELAS, RAFINESQUE,
North Texas State Univ., Denton. Dept. of Bio-

logical Sciences.
R. D. Judy, Jr., and P. H. Davies.
Bulletin of Environmental Contamination and Toxicology, Vol. 22, p 88-94, 1979. 2 fig, 3 tab, 14 ref.

Descriptors: *Zinc, *Calcium, *Toxicity, *Minnows, Metals, Mortality, Water chemistry, Lethal limit, Bioassay, Hardness(Water), Nitrates, Inhibition, Fish physiology.

The role Ca++ plays in the inhibition of Zn++ toxicity was examined in three experiments. First, minnows were treated with Zn++ alone to determine the 96-h LC50 (3.1 mg/L). Second, various levels of Ca(NO3)2 were added to 6.0 mg/L zinc levels. The addition of Ca++ inhibited zinc toxicity from 65% in soft tap water to 0% in 117.5 mg/L Ca++ water. Finally, more detailed studes of the definitive Ca++ levels needed to reduce mortality were performed. Definitive inhibition of Zn++ toxicity by Ca++ additions was shown as a graded response of mortality in all test tanks. (Deal-EIS)
W79-08318

A COMPARATIVE STUDY OF THE EFFECT OF ACUTE AND CHRONIC MERCURIC CHLORIDE TREATMENT ON THE ACTIVITIES OF A FEW DIGESTIVE ENZYMES OF A TELEOST FISH, CHANNA PUNCTATUS,
D.A.V. Coll., Muzaffarnagar (India). Dept. of Zoology.
K. V. Sastry, P. K. Gupta, and P. V. Malik.
Bulletin of Environmental Contamination and Toxicology, Vol. 22, p 28-34, 1979. 3 tab, 20 ref.

Descriptors: *Mercury, *Toxicity, *Enzymes, *Channa, *Tissue analysis, Heavy metals, Chemical analysis, Amino acids, Inhibition, Biochemistry chlorides, Teleosts, Fish physiology, Animal metabolism, Maltase, Lactase, Dipeptidase, Water pollution effects.

In this study a comparison of the effect of exposure of Channa punctatus to LC(50) (1.8 mg/L) and a sublethal concentration (0.30 mg/L) of mercuric chloride on the activities of maltase, lactase leucyl-L-glycine dipeptidase and lipase was performed. After 96 hr of treatment, a slight elevation in maltase activity was recorded in all the portions of the digestive syste. Lipase and leucyl-L-glycine dipeptidase showed inhibition in activity. Chronic treatment for 20 days revealed a significant inhibition in the activities of all the four enzymes. (Deal-EIS)
W79-08319

ALKANES IN FISH FROM THE BUCCANEER OILFIELD,
Houston Univ., TX. Dept. of Biophysical Sciences.
B. S. Middleditch, E. S. Chang, B. Basile, and S. R. Missler.
Bulletin of Environmental Contamination and Toxicology, Vol. 22, p 249-257, 1979. 1 fig, 1 tab, 10 ref.

Descriptors: *Oil, *Fish physiology, *Alkanes, *Tissue analysis, Path of pollutants, Oil pollution, Organic compounds, Offshore platforms, Bass, Catfish, Gas chromatography, Chemical analysis, Food chains, Aromatic compounds, Water pollution effects, Buccaneer oil field, Louisiana, Public health.

Twenty-five species of fish from the Buccaneer oilfield were examined for petroleum-derived alkanes. There was good evidence for petroleum alkanes in A. probatocephalus, C. spilopterus, C. arenarius, M. undulatus, P. saltatrix, P. porosissimus, P. rubio, S. brasiliensis, S. caprinus, S. papillosum, S. plagiusa, S. foetens, and U. floridanus. It was also possible that A. felis, C. faber, and O. pardus were contaminated, but there were no petroleum alkanes in the other nine species examined. Levels of petroleum alkanes were usually higher in livers than in muscle tissue. (Deal-EIS)
W79-08320

UPTAKE, TISSUE DISTRIBUTION, METABOLISM AND ELIMINATION N-OCTANO-1-14C-HYDROXAMIC ACID BY BROOK TROUT,
Bedford Inst. of Oceanography, Dartmouth (Nova Scotia).
D. C. Darrow, and R. F. Addison.
Bulletin of Environmental Contamination and Toxicology, Vol. 22, p 265-270, 1979. 1 tab, 12 ref.

Descriptors: *Absorption, *Brook trout, *Animal metabolism, *Fry, *Tissue analysis, *Bio accumulation, Organic compound, Acids, Fish physiology, Growth stages, Radioactivity techniques, Tracers, Path of pollutants, Biochemistry, Organic acids.

Brook trout fry rapidly accumulated and cleared a labelled medium chain length alklhydroxamic acid. Appreciable amounts of accumulated material were evidently converted to the corresponding carboxylic acid (whence they entered the normal metabolism of the animal via the lipoclastic cycle). The detoxification process (hydroxamate-carboxylate) evidently does not proceed sufficiently rapidly to offer complete protection to the fish, however, as in previous studies, OHA proved lethal to salmon fry. (Deal-EIS)
W79-08321

UPTAKE AND METABOLISM OF SELENIUM BY OYSTERS,
Southhampton Univ. (England). Dept. of Oceanography.
J. J. Wrench.
Marine Science Communications, Vol. 5, No. 1, p 47-59, 1979. 2 fig, 2 tab, 12 ref.

Descriptors: *Oyster, *Animal metabolism, *Absorption, *Selenium, *Tissue analysis, *Bioaccumulation, Metals, Amino acids, Proteins, Biochemistry, Enzymes, Chemical analysis, Path of pollutants, Phytoplankton, Commercial shellfish, Bacteria.

Observation of the equilibration of 75Se with the tissues of Ostrea edulis suggested that the highest concentration factor occurred in the digestive gland. A study of the form of selenium in this tissue after assimulation of 75Se from water or labelled phytoplankton showed that the majority of selenium, in both cases, was strongly associated with protein. Enzymic hydrolysis of protein and subsequent chromatography of hydrolytic products revealed the presence of breakdown products of selenium analogues of the common sulphur amino acids. (Deal-EIS)
W79-08322

EFFECTS OF LEAD NITRATE ON THE ACTIVITIES OF A FEW ENZYMES IN THE KIDNEY AND OVARY OF HETEROPNEUSTES FOSSILIS,
D. A. V. Coll., Muzaffarnagar (India). Dept. of Zoology.
K. V. Sastry, and M. K. Agrawal.
Bulletin of Environmental Contamination and Toxicology, Vol. 22, p 55-59, 1979. 1 tab, 22 ref.

Descriptors: *Lead, *Toxicity, *Enzymes, *Channa, *Tissue analysis, Heavy metals, Chemical analysis, Inhibition, Fish physiology, Animal metabolism, Teleosts, Biochemistry, Nitrates, Water pollution effects, Kidney, Phosphatase, Lipase, Urease, Animal pathology.

The effect of LC(50) and a sublethal concentration of lead nitrate on the activities of alkaline phosphatase, acid phosphatase, glucose-6-phosphatase, lipase and urease in the kidneys and ovaries of a teleost fish, Channa punctatus has been examined after 96 hr and 30 days, respectively. The results show that all five enzymes in the two tissues are inhibited significantly at both the experimental stages. However, the inhibition produced after 30 days by the sublethal concentration is higher, indicating the cumulative action of lead. Further, the inhibition of enzymes is more marked in kidney than in the ovary. (Deal-EIS)
W79-08324

ACCUMULATION OF POLYCHLORINATED BIPHENYL (PHENOCLOR DP6) BY ESTUARINE FISH,
Bordeaux Univ., Talence (France). Lab. de Physiologie de la Nutrition.
J. F. Narbonne.
Bulletin of Environmental Contamination and Toxicology, Vol. 22, p 60-64, 1979. 3 tab, 17 ref.

Descriptors: *Polychlorinated biphenyls, *Fish physiology, *Mullets, *Tissue analysis, *Bioaccumulation, Path of pollutants, Chemical analysis, Juvenile growth stage, Industrial wastes, Water chemistry, Gas chromatography, Animal metabolism, Organic compounds, Phenoclor DP6, Liver, Tissue concentration.

The purpose of this study was to measure the concentration coefficient and the tissue distribution of a French PCB (Phenoclor DP6) from water and from food in juvenile grey mullets (Chelon labrosus). Fish intoxicated for 30 days by Phenoclor DP6 added either to water or food revealed an accumulation of PCB in all tissues measured. The highest concentration was found in the liver. There was a higher accumulation of PCB from water than from food. Little or no Phenoclor DP6 was metabolized by these fish. The results provide important data on the PCB accumulation in food chains. (Deal-EIS)
W79-08325

EFFECTS OF CRUDE AND DIESEL OIL SPILLS ON PLANT COMMUNITIES AT PRUDHOE BAY, ALASKA, AND THE DERIVATION OF OIL SPILL SENSITIVITY MAPS,
Colorado Univ., Boulder. Inst. of Arctic and Alpine Research.
For primary bibliographic entry see Field 5C.
W79-08326

POLYCHLORINATED BIPHENYL ACCUMULATION IN GREY MULLETS (CHELON LABROSUS): EFFECT OF AGE,
Bordeaux Univ., Talence (France). Lab. de Physiologie de la Nutrition.
J. F. Narbonne.
Bulletin of Environmental Contamination and Toxicology, Vol. 22, p 65-68, 1979. 1 fig, 2 tab, 9 ref.

Descriptors: *Polychlorinated biphenyls, *Mullets, *Age, *Tissue analysis, *Bioaccumulation, Path of pollutants, Fish physiology, Animal metabolism, Chemical analysis, Gas chromatography, Pesticide residues, Organic compounds, Chlorinated hydrocarbon pesticides.

Twelve mullets 2.5 years old and 12 mullets 3.5 years old were fed a dry fish diet (AQUALIM) contaminated by DP6 to a concentration of 50 micrograms/g. Groups of 4 fishes were sacrificed after 8, 15 and 30 days of DP6 ingestion and analyzed by gas chromatography. The relative peaks heights of individual DP6 isomers in the chromatogram did not vary with the age of the fish. This would indicate that there is no selective metabolism of specific DP6 components in mullets. The DP6 ingested by the fish was stored in carcass according to a logarithmic curve independent of age. However, the DP6 concentration in carcass appeared higher in older fishes than in young fishes. This would indicate that PCB concentration in fish is dependent on food intake. (Deal-EIS)
W79-08327

ACUTE TOXICITY OF CADMIUM, COPPER, AND MERCURY TO LARVAL AMERICAN LOBSTER HOMARUS AMERICANUS,
Environmental Research Lab., Narragansett, RI.
M. W. Johnson, and J. H. Gentile.
Bulletin of Environmental Contamination and Toxicology, Vol. 22, p 258-264, 1979. 1 fig, 24 ref.

Descriptors: *Larval growth stage, *Toxicity, *Cadmium, *Mercury, *Copper, Lobsters, Mortality, Growth stages, Heavy metals, Crustaceans, Commercial shellfish, Bioassay, Municipal wastes, Industrial wastes, Path of pollutants, Homarus.

Stage I lobster larvae were exposed to several concentrations of cadmium, copper and mercury. The 96 hr LC-50 values were 78, 48, and 20 micrograms/L, respectively. Comparison with data on copper toxicity to adults reveals an elevated sensitivity in larvae (2X). No comparable data exist for the acute effects of mercury or cadmium on adults. In view of the heightened sensitivity in larvae it was proposed that this growth stage be employed in future toxicity testing. (Deal-EIS)
W79-08328

SPATIAL AND TEMPORAL DYANAMICS OF BACTERIAL PHOTOSYNTHETIC POPULATIONS IN AN ANAEROBIC POND OF SULFUROUS WATER, DINAMICA ESPACIOTEMPORAL DE LAS POBLACIONES BACTERIANAS FOTOSINETICAS EN UNA LAGUNA ANAEROBIA DE AGUAS SULFUROSAS,
Barcelona Univ. (Spain). Dept. of de Microbiologia.
R. Guerrero, and C. Abella.
Oecologia Aquatica, Vol. 3, p 193-205, 1978. 12 fig, 3 tab, 18 ref. (English Summary).

Descriptors: *Phytoplankton, *Photosynthesis, *Bacteria, Freshwater bacteria, *Ponds, *Anaerobic ponds, Anaerobic bacteria, Anaerobic conditions, *Hydrogen sulfide, Chemical analysis, Chromatium, Chlorobium, Food chain, Sulfur bacteria, Sulfur compounds, Sulfides, Baynoles Lake, Spain.

The Siso pond is a small eutrophic water body located near Banyoles Lake (Gerona, Spain), and a part of the same karstic system. The evolution of the photosynehetic bacterial population, composed mainly by Chromatium violascens, clorobium limicola and Chlorobium phaeovibrioides, has been followed. The two genera present different strategies: Chromatium is able of active motion and can move in search of its H2S optimum; Chlorobium is immotile and adaptates itself to a broader range of H2S concentration and ilumination. Therefore, Chromatium is the dominant bacteria in the Siso pond when the H2S concentration is between 20 and 40 mg/1; it reaches the surface in winter time (January-February), when the illumination is low. Correspondingly, Chlorobium is the dominant bacteria when the H2S concentration is over 50 mg/1 and reaches the surface in summer and fall time. Thus, the chemical compound which determines the bacterial population composition is sulfide; its concentration depends on other factors, as sulfate and temperature, and its vertical distribution on the stational thermal structure. (Katz-EIS)
W79-08329

MASS DEVELOPMENT OF THE PHYTOFLAGELLATE PRYMMESIUM PARVUM CARTER (HAPTOPHYCEAE) IN A COASTAL LAGOON IN THE EBRO DELTA (DESARROLLO MASIVO DEL FITOFLAGELADO PRYMNESIUM PARVUM CARTER (HAPTOPHYCEAE) EN UNA LAGUNA COSTERA DEL DELTA DEL EBRO),
Barcelona Univ. (Spain). Dept. de Ecologia.
F. A. Comin, and X. Ferrer.
Oecologia Aquatica, Vol. 3, p 207-210, 1978. 1 fig, 1 tab, 22 ref. (English summary).

Descriptors: *Phytoplankton, *Mortality, *Toxicity, *Fish kill, *Toxic algae, Phytoflagellate, *Prymnesium parvum, Ebro delta, Spain, Water quality, Water chemistry, Nutrients.

The mass development of the toxic alga Prymnesium parvum Carter (2 x 10 to the 8th power cells/l) caused on a large scale the death of fish in a coastal lagoon in the Ebro Delta. The water acquired a chocolate-red colour for two months (November and December 1977). This situation occurred after the entrance of great quantities of sea water, driven by the wind. Data on the chemical parameters of the water and on the species composition of the phytoplankton are listed. (Katz-EIS)
W79-08330

TOXICITY OF PRUDHOE BAY CRUDE OIL TO ALSKAN ARCTIC ZOOPLANKTON,
Kansas Univ., Lawrence. Dept. of Systematics and Ecology.
For primary bibliographic entry see Field 5C.
W79-08331

HYDROCARBONS AND MICROBIAL ACTIVITIES IN SEDIMENT OF AN ARCTIC LAKE ONE YEAR AFTER CONTAMINATION WITH LEAD GASOLINE,
Louisville Univ., KY. Dept. of Biology.
For primary bibliographic entry see Field 5C.
W79-08333

CRUDE OIL BIODEGRADATION IN ARCTIC TUNDRA PONDS,
Cincinnati Univ., OH. Dept. of Biological Sciences.
For primary bibliographic entry see Field 5C.
W79-08334

EFFECT OF PETROLEUM HYDROCARBONS ON MICROBIAL POPULATIONS IN AN ARCTIC LAKE,
Marine Biological Lab. Woods Hole, MA. Ecosystems Center.
M. J. Jordan, J. E. Hobbie, and B. J. Peterson.
Arctic, Vol. 31, p 170-179, 1978. 1 fig, 5 tab, 17 ref.

Descriptors: *Oil, *Oil spills, Water pollution effects, *Alaska, Prudhoe Bay, Bacteria, Degradation(Decomposition), *Arctic, Lakes, Microbiology, Microorganisms, Water chemistry, Sediments, Petroleum hydrocarbons, Methodology, Carbon radioisotopes, Carbon 14, Laboratory tests, Oil lake.

A sea-curtain enclosed section of a lake 240 mk south of Prudhoe Bay, Alaska was exposed to Prudhoe crude oil in July 1976. One year following exposure to the oil, no significant differences were detected between the waters or sediments of the oiled versus control area in rates of turnover of glucose. Total numbers of bacteria were slightly higher in oiled than in control waters. There were no differences in numbers of sediment bacteria. Rates of uptake of hexadecane and napthalene by sediment microbes were not linear with time. Hexadecane was taken up sooner and faster than was napthalene. In some incubations, significantly (88-95% probability level) greater rates of hydrocarbon uptake were measured for oiled than for control sediments. Only incorporated, not mineralized, hydrocarbons were measured due to methodological problems. Several methods of using 14C-labelled hydrocarbons in a field situation are presented. (Katz-EIS)
W79-08335

LETHAL EFFECT OF GYMNODINIUM SP. ON THE ROTIFER, BRACHIONUS PLICATILIS (IN JAPANESE),
Nagasaki Univ. (Japan). Faculty of Fisheries.
T. Abe, and K. Hirayama.
Bulletin of the Faculty of Fisheries Nagasaki University, No. 46, p 1-6, 1979. 4 fig, 1 tab, 9 ref. (English summary).

Descriptors: *Red tide, *Gymnodinium, *Toxicity, *Rotifers, Phytoplankton, Mortality, Aquatic animals, Cytological studies, Growth rates, Lethal limit, Water chemistry, Growth stages, Bioassay, Public health, Bioassay.

Gymnodinium sp. (tentatively named as G. type '65) is a main causative organism of red tides occurring frequently at Omura Bay since 1965. However, the toxicity of this species to aquatic animals has still remained doubtful. This study demonstrates the lethal effect of G. type '65 on the rotifer, Brachionus plicatilis. Culture of G. type '65 displayed the lethal effect on the rotifer more fetal in exponential growth stage (24-hr. Tlm: 3.3 cells/ml) than in stationaly stage (24-hr. Tlm: 195 cells/ml). If the living cells were filtered out or destroyed by ultrasonics, the suspension of G. type '65 even at the high concentration of 8 approx. 10 X 10000 cells/ml completely lost the lethal ability to the rotifer. These facts indicate that the existence of living cells is strictly essential for G. type '65 to display the lethal effect on the rotifer. (Deal-EIS)
W79-08336

RUNOFF WATER QUALITY FROM VARYING LAND USES IN SOUTHEASTERN ARIZONA,
Science and Education Administration, Tucson, AZ. Southwest Rangeland Watershed Research Center.
H. A. Schreiber, and K. G. Renard.
Journal of Range Management, Vol. 31, No. 4, p 274-279, July 1978, 5 fig, 2 tab, 15 ref.

Descriptors: *Runoff, *Surface waters, *Water pollution sources, *Water pollution effects, *Environmental effects, Water quality, Water pollution control, Suspended solids, Urbanization, Grazing, Calcareous soils, Dissolved solids, Phosphates, Nitrates, Range management, Soil-water-plant relationships, Arizona, Land use.

Although the collection of water quality data has become a necessity under the 1972 Federal Water Pollution Control Act Amendments and in the preparation of environmental impact statements, such information is often lacking, especially the impact of grazing on the chemical constituents of runoff water. This study seeks to identify and control sources of non-point pollution by collection of surface runoff samples from ungrazed brush-covered rangelands, recently subdivided rangeland still partly brush-covered but disturbed by urbanization, and grass-covered grazed rangeland at the Walnut Gulch Experimental Watershed near Tombstone, Arizona. Results indicated that despite the effects of grazing, the urbanized watersheds had poorer quality water, suggesting that the non-agricultural activities associated with housing development are more detrimental to water quality than those associated with undisturbed or grazed rangelands. Contrasts between the geology of grass and brush areas suggest that mineral sources affect the qualitative changes in dissolved solids. Calcareous soils were found to produce higher Ca and total dissolved solids, while phosphate concentrations were higher in the grass covered non-calcareous watersheds than in the brush-covered calcareous watersheds. The authors believe that phosphate may have its origins in the soil rather than from grazing while nitrate levels, found to increase in runoff from semi-urban areas, are a consequence of human urbanization. (Tickes-Arizona)
W79-08372

TRACE METALS AND MARINE PRODUCTION PROCESSES. PROCEEDINGS OF A WORKSHOP HELD AT THE PACIFIC MARINE ENVIRONMENTAL LABORATORY FEBRUARY 28 - MARCH 2, 1978,
National Ocean and Atmospheric Administration, Seattle, WA. Pacific Marine Environmental Lab.
For primary bibliographic entry see Field 5C.
W79-08381

BACTERIA CRITERIA,
Environmental Protection Agency, Washington, DC. Div. of Water Quality Standards.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-254 457, Price codes: A02 in paper copy, A01 in microfiche. April 1972. 18 p.

Descriptors: *Water quality control, *Water pollution, *Bacteria, Water pollution control, Recreation, Fishing, Potable water, Shellfish, Boating, Wastes.

The water quality standards program is directed by the Environmental Protection Agency, which has responsibility for approving state-adopted standards, evaluating adherence to the standards, and overseeing enforcement of standards compliance. The first nationwide strategy for water quality management standards contain four major elements: (1) the uses (recreational, drinking, fish and wildlife propogation, industrial or agricultural) to be made of the interstate water; (2) criteria to protect those uses; (3) implementation plans (for needed industrial-municipal waste treatment improvements) and enforcement plans; and (4) an antidegradation statement to protect existing high quality water. State-adopted bacteria criteria for

the individual waters of each state are surveyed. (Vloedman-Florida)
W79-08403

TEMPERATURE (TEMPERATURE STANDARDS FOR NATIONWIDE WATER QUALITY MANAGEMENT).
Environmental Protection Agency, Washington, DC. Div. of Water Quality Standards.
For primary bibliographic entry see Field 4C.
W79-08425

MIXING ZONES (RECOMMENDATIONS FOR A NATIONWIDE STRATEGY FOR WATER QUALITY MANAGEMENT).
Environmental Protection Agency, Washington, DC. Div. of Water Quality Standards.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-256 352, Price codes: A02 in paper copy, A01 in microfiche. September 2, 1971, 13 p.

Descriptors: *State governments, *Water quality control, *Water quality standards, *Water pollution, Water pollution control, Standards, Streamflow, Aquatic animals, Barriers, Aquatic microbiology, Plankton.

The Water Quality Standards Division, Environmental Protection Agency has responsibility for approving State-adopted standards, evaluating adherence to the standards, and overseeing enforcement of standards compliance. This first nationwide strategy for water quality management standards contains four major elements: (1) the use (recreational, drinking, fish and wildlife propogation, industrial or agricultural) to be made of interstate water; (2) criteria to protect those uses; (3) implementation and enforcement plans (for needed industrial-municipal waste treatment improvements); and (4) an antidegradation statement to protect existing high quality waters. State-adopted standards for mixing zones are surveyed. Mixing zones are areas, unavoidably and harmfully polluted, used for mixing of discharged waters with receiving waters. They have defined and identifiable limits. The waters outside the zones must meet the standards for that particular body of water when several mixing zones are located close together. The Water Quality Criteria report recommends that they lie on the same side of the stream, to allow a continuous passageway for aquatic organisms on the opposite side. (Vloedman-Florida)
W79-08428

WILLAMETTE BASIN COMPREHENSIVE STUDY OF WATER AND RELATED LAND RESOURCES: APPENDIX L--WATER POLLUTION CONTROL,
Pacific Northwest River Basins Commission, Portland, OR. Willamette Basin Task Force.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A036 764, Price codes: A07 in paper copy, A01 in microfiche. Chaired by Federal Water Pollution Control Administration, 1969. 114 p, 12 tab, 9 fig, 4 maps, 27 photos.

Descriptors: Water pollution, *Water quality, *Water pollution control, *Water quality control, Oregon, Water pollution abatement, Heated water, Thermal pollution, Water pollution treatment, Planning, Water treatment, Water pollution sources, Water pollution effects, Standards, Toxicity, Sediments, Dissolved solids, Bacteria, Organic wastes, River basins, River basin development, Flow abatement, *Willamette River(OR).

This study was taken to plan for the proper development of water and related land resources of the Willamette River Basin in Oregon. This Appendix L--of the functional appendices is based on data contained in the three supporting appendices, A through C. Its objective is to appraise the existing level of water quality and to present recommendations for the restoration and maintenance of a proper level of water quality in the basin. Included are the identification of water and land-use practices adversely impacting water quality and suggestions to reduce such impacts; the determination of effluent standards for various sources; and the determination to regulate streamflow, especially as applied to water quality. Primary and secondary pollutional effects are outlined; factors considered include organic waste, heat, bacteria, toxics, sediments and dissolved solids. Present status of water quality is assessed by reviewing sources of pollution, evaluation factors, and water quality requirements and objectives. Each subbasin is discussed. Future demands are projected using waste projections from principal sources. Lastly, alternative solutions for providing water quality suitable for specific uses are presented. The combinations developed to meet 1980 goals are relatively specific; those combinations developed to meet and waste loads for 2000 and 2020 are progressively less specific but are adequate for long-range planning. (See also W79-08433) (Zayac-NC)
W79-08445

CADMIUM BIOACCUMULATION ASSAYS. THEIR RELATIONSHIP TO VARIOUS IONIC EQUILIBRIA IN LAKE SUPERIOR WATER,
Environmental Research Lab.-Duluth, MN.
For primary bibliographic entry see Field 5C.
W79-08450

THE STRUCTURE OF MEIOFAUNA COMMUNITIES,
Oslo Univ. (Norway). Inst. for Marine Biology.
J. S. Gray.
Sarsia, Vol. 64, No. 4, p 265-272, 1978. 4 fig, 4 tab, 25 ref.

Descriptors: Benthos, *Benthic fauna, *Meiofauna, Kelps, Marine algae, *Methodology, Water pollution effects, England, Coasts, Animal groupings, Animal populations, Diversification, *Diversity, Marine Meiofauna communities, Diversity index, Nematodes, Evenness values, Water pollution effects.

Individuals and species of meiofauna from kelp holdfast along the north-east coast of England fitted both a logarithmic series and a log-normal model using data from unpolluted sites. At a polluted site the fit was generally less good to both models. In general, however, the log-normal was a closer fit to the observed data than the log-series, as has been found in other marine data. Using a neutral model, which eliminates the influence of biological interaction, diversity was found to be higher than predicted in meiofauna from kelp holdfasts and in Gastrotricha from sand beaches in eastern U.S.A. At a polluted site and with data for nematodes from an unpolluted site, diversity was not significantly different from neutral model predictions, but evenness was significantly lower. Unlike terrestrial ecosystems therefore, biological interactions lead to higher diversity values in marine meiofaunal communities than neutral model predictions. Pollution has the effect of increasing dominance and thus lowering diversity values to neutral model predictions. (Katz-EIS)
W79-08451

IMPINGEMENT SAMPLING FREQUENCY. A MULTIPLE POPULATION APPROACH,
Lawler, Matusky, and Skelly, Tappan, NY.
F. M. El-Shamy.
Environmental Science & Technology, Vol. 13, No. 3, p 315-320, 1979. 6 tab, 6 ref.

Descriptors: *Methodology, Juvenile fish, Fish behavior, Mortalities, Fish kills, Power plants, Cooling, Cooling water, Monitoring, Sampling, Lake Ontario, Nine Mile Point Nuclear Station Unit 1, New York, Scriba, Fresh water fish, Smelts, Bass, Alewife, *Impingement, *Impingent sampling frequency.

Two years of impingement data were analyzed to design a sampling program based on the optimum allocation method. The method was applied to all species combined and then separately to each species. By sampling most intensively during months of peak fish abundance, a more precise estimate of yearly impingement rate is possible than when sampling was evenly distributed throughout the year. A 25% reduction in the current annual sampling program, when reallocated, decreased the width of 95% confidence intervals for the mean number of fish impinged daily. This width decreased from the original plus or minus 15.8% to plus or minus 4% for all fish combined, from plus or minus 32% to plus or minus 7% for alewife, from plus or minus 41% to plus or minus 17% for white perch, and from plus or minus 16% to plus or minus 11% for rainbow smelt. An improvement in precision of estimation was also predicted for other species. The analyses presented here suggest that, for each representative species, a different sampling scheme is necessary unless the 'species of interest' concept is ignored. (Katz-EIS)
W79-08452

DETERMINATION OF SEVERAL INDUSTRIAL AROMATIC AMINES IN FISH,
Food and Drug Administration Washington, DC. Div. of Chemical Technology.
G. W. Diachenko.
Environmental Science & Technology, Vol. 13, No. 3, p 329-333, 1979. 3 fig, 3 tab, 20 ref.

Descriptors: *Methodology, *Chemical analysis, Freshwater fish, Water pollution effects, *Buffalo River, *Delaware River, New York, New Jersey, Gram chromatography, Minnows, Carp, Path of pollutants, Public health, Aromatic compounds, *Aromatic amines, Chemical wastes, Dyestuffs.

A procedure is described for the determination of selected industrial aromatic amines in fish. Ground fish tissue is digested with aqueous sodium hydroxide and extracted with benzene. The extract is washed with dilute acid and cleaned up using gel permeation chromatography. The amines are separated and quantitated using nitrogen-selective gas-liquid chromatography. Recoveries of N-ethyl-N-phenyl-benzylamine, N-ethyl-N-(m-tolyl)benzylamine, N,N-dibenzylmethylamine, diphenylamine, and N-phenyl-1-naphthylamine from fish tissue fortified at levels of 20-100 ppb (micrograms per kilogram) averaged at least 80%. Recoveries of 1-naphthylamine and 3,3'-dichlorobenzidine were somewhat lower. Fish samples obtained from rivers near nine textile and dyestuff manufacturers known to use certain aromatic amines have been analyzed. 1-Naphthylamine was detected in fish from the Buffalo and Delaware Rivers downstream from two dyestuff manufacturers. N-Ethyl-N-phenylbenzylamine and N-ethyl-N(m-toyl)benzylamine were also detected in the Buffalo River fish. (Katz-EIS)
W79-08453

THE RECOVERY AND HEMATOLOGICAL REHABILITATION OF CHLORINE STRESSED ADULT RAINBOW TROUT (SALMO GAIRDNERI),
Consumers Power Co., Jackson, MI. Dept. of Environmental Services.
For primary bibliographic entry see Field 5C.
W79-08454

LONG-TERM EFFECTS OF ZINC EXPOSURES ON BROOK TROUT (SALVELINUS FONTINALIS),
Environmental Research Lab.-Duluth, MN.
For primary bibliographic entry see Field 5C.
W79-08455

ARSENIC CONCENTRATIONS IN WATER AND FISH FROM CHAUTAUQUA LAKE, NEW YORK,
State Univ. of New York Coll. at Buffalo. Dept. of Biology.
R. E. Foley, J. R. Spotila, J. P. Geisy, and C. H. Wall.
Environmental Biology of Fish, Vol. 3, No. 4, p 361-367, 1978. 2 fig, 2 tab, 27 ref.

Descriptors: *Arsenic compounds, Arsenicals(Pesticides), Chautauqua Lake, New York, Herbicides, *Sodium arsenite, Lakes, Lake water, *Public health, Perch, Crappies, Muskellunge, Water pollution effects, Path of pollutants, Bass.

Arsenic persists in Chautauqua Lake, New York waters 13 years after cessation of herbicide (sodium arsenite) application and continues to cycle within the lake. Arsenic concentrations in lake water ranged from 22.4-114.8 micrograms per liter .x = 49.0 micrograms per liter. Well water samples generally contained less than 10 micrograms per liter arsenic. Arsenic concentrations in lake water exceeded U.S. Public Health Service recommended maximum concentrations (10 micrograms per liter) and many samples exceeded the maximum permissible limit (50 micrograms per liter). Fish accumulated arsenic from water but did not magnify it. Fish to water arsenic ratios ranged from 0.4-41.6. Black crappie (Pomois nigromaculatus) contained the highest arsenic concentrations (0.14-2.04 micrograms per liter, x = 0.7 micrograms per liter), perch (Perca flavescens), muskellunge (Esox masquinongy) and large-mouth bass (Micropterus salmoides) contained the lowest concentrations (0.02-0.13 micrograms per liter). Arsenic concentrations in fish do not appear to pose a health hazard for human consumers. (Katz-EIS)
W79-08456

EFFECTS OF ALDRIN EXPOSURE ON SNOW GEESE IN TEXAS RICE FIELDS,
Fish and Wildlife Service, Victoria, TX. Gulf Coast Field Station.
For primary bibliographic entry see Field 5C.
W79-08458

EFFECT OF L-DOPA, BROMOCRIPTON AND LERGOTRILE ON PROLACTIN CELL ACTIVITY AND HYDROMINERAL REGULATION IN YEARLING COHO SALMON, ONCORHYNCHUS KISUTCH,
Guelph Univ. (Ontario). Dept. of Zoology.
For primary bibliographic entry see Field 5C.
W79-08459

AN ATTEMPT TO COMBINE A BIOLOGICAL PURIFICATION OF MUNICIPAL SEWAGES WITH THEIR UTILIZATION IN FISHERIES, (IN POLISH),
Instytut Oceanografii Rybackieg, Szczcin (Poland).
For primary bibliographic entry see Field 5C.
W79-08463

SAFE ZINC AND COPPER LEVELS FROM THE SPRING CREEK STEELHEAD TROUT IN THE UPPER SACRAMENTO RIVER, CALIFORNIA,
California State Dept. of Fish and Game, Rancho Cordova. Water Pollution Control Lab.
For primary bibliographic entry see Field 5C.
W79-08465

THE EFFECTS OF OIL SPILLS ON PHYTOPLANKTON IN AN ARCTIC LAKE AND PONDS,
Cincinnati Univ., OH. Dept. of Biological Sciences.
For primary bibliographic entry see Field 5C.
W79-08466

5B. Sources Of Pollution

RELIABILITY OF AQUATIC INSECTS VERSUS WATER SAMPLES AS MEASURES OF AQUATIC LEAD POLLUTION,
Colorado Div. of Wildlife, Montrose.
For primary bibliographic entry see Field 5A.
W79-08036

FATE AND EFFECTS OF CADMIUM IN AN EXPERIMENTAL MARINE ECOSYSTEM,
Biologische Anstalt Helgoland, Hamburg (Germany, F. R.).
For primary bibliographic entry see Field 5A.
W79-08037

DETERMINATION OF THE ABSORPTION OF CR+6 AND CR+3 IN AN ALGAL CULTURE OF CHLORELLA PYRENOIDOSA USING 51CR,
Roskilde Univ. Center (Denmark). Inst. for Environment, Technology and Society.
For primary bibliographic entry see Field 5A.
W79-08038

INVESTIGATION ON THE DISTRIBUTION OF DDT AND AROCLOR 1254 IN LABORATORY-GROWN MARINE PHYTOPLANKTON,
Institut Rudjer Boskovic, Rovinj (Yugoslavia). Center for Marine Research.
For primary bibliographic entry see Field 5A.
W79-08039

MOBILIZATION AND ACCUMULATION OF SEDIMENT BOUND HEAVY METALS BY ALGAE,
Ottawa Univ. (Ontario). Dept. of Biology.
For primary bibliographic entry see Field 5A.
W79-08040

EFFECTS OF HEAVY METALS ON BENTHIC MACROINVERTEBRATE DENSITIES IN FOUNDRY COVE ON THE HUDSON RIVER,
New York Univ. Medical Center, NY. Inst. of Environmental Medicine.
For primary bibliographic entry see Field 5A.
W79-08042

ACUTE TOXICITY OF COPPER, CHROMATE, ZINC, AND CYANIDE TO FRESHWATER FISH: EFFECT OF DIFFERENT TEMPERATURES,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Biology.
M. J. Smith, and A. G. Heath.
Bulletin of Environmental Contamination and Toxicology, Vol. 22, p 113-119, 1979. 2 fig, 2 tab, 10 ref.

Descriptors: *Bioassay, *Water temperature, *Toxicity, *Cyanide, *Chromate, Copper, Zinc, Metals, Rainbow trout, Channel catfish, Sunfishes, Shiners, Fish physiology, Mortality, Freshwater fish, Laboratory tests, Bioassays.

24-h bioassay tests were used to determine the lethal concentrations to freshwater fish of potassium cyanide, copper sulfate, zinc sulfate and potassium dichromate at three temperatures (5, 15, 30 degrees C). Young of rainbow trout, golden shiner, bluegill, goldfish and channel catfish were used. Temperature had a considerable effect on cyanide and chromate toxicity to goldfish, less effect in golden shiners, and none with the other species tested. There was a tendency for zinc to be more toxic at the higher temperatures to goldfish and bluegill, but not to shiners or trout. As for copper, there was a tendency toward a higher sensitivity at the higher temperatures in goldfish, channel catfish, and trout but the converse was seen in bluegill. (Deal-EIS)
W79-08043

TOXIC SUBSTANCES IN THE EFFLUENTS OF PETROCHEMICAL PLANTS AND THEIR EFFECT ON AQUATIC ORGANISMS (REVIEW),
Irkutskii Gosudarstvennyi Univ. (USSR). Scientific Research Inst. of Biology.
Ya. M. Grushko, O. M. Kozhova, and L. M. Mamontova.
Hydrobiological Journal, Vol. 14, No. 2, p 47-51, 1978. 52 ref.

Descriptors: *Toxicity, *Water quality standards, *Chemical wastes, Industrial wastes, Commercial fishing, Water quality control, Waste water treatment, Organic compounds, Metals, Daphnia, Water chemistry, Biodegradation, Microbial degradation, Aromatic compounds, Waste water disposal.

The literature on toxicity of the components of petrochemical effluents reviewed. It is shown that the toxic concentrations of many compounds are considerably lower than the maximum concentrations of petroleum products stipulated for waters utilized by the fishing industry. It is concluded that it is essential to dilute waste-waters (including those that have undergone multistage purification) before discharging them, to establish standards governing the entry of individual components of wastewaters into surface waters, and to conduct further investigations on the microbiological breakdown of residual petroleum products in surface waters. (Deal-EIS)
W79-08045

ALTERATIONS IN CALCIUM ACCUMULATION BEHAVIOR IN RESPONSE TO CALCIUM AVAILABILITY AND POLYCHLORINATED BIPHENYL ADMINISTRATION,
Southeastern Massachusetts Univ., North Dartmouth. Dept. of Biology.
W. I. Hatch, and D. W. Allen.
Bulletin of Environmental Contamination and Toxicology, Vol. 22, p 172-174, 1979. 1 tab, 5 ref.

Descriptors: *Polychlorinated biphenyl, *Snails, *Pesticide toxicity, *Cepeae, Aroclors, Animal behavior, Calcium, Animal physiology, Animal metabolism, Toxicity, Calcium carbonate, Water pollution effects.

The snail Cepeae nemoralis has been frequently observed rasping at the shells of conspecifics in areas of their distribution which were low in lime. This experiment examined the effects of PCBs upon calcium accumulation as a reflection of alterations in calcium appetitive behavior. Three groups of snails were tested. One group received a calcium abundant diet, one a calcium deficient diet and the third a calcium abundant diet with PCBs (Aroclors) added. Among snails receiving the calcium-abundant diet, damage was produced in 3% of the study population and penetration did not occur. In the calcium deficient group, however, damage was produced by 97% of the snails with 9% resulting in penetration. Administration of PCBs in food resulted in increased shell abrasion at all doses tested. In response to increasing amounts of the PCB mixture, penetration also increased, though not in a linear fashion. (Deal-EIS)
W79-08046

BROWN PELICAN: POPULATION STATUS, REPRODUCTIVE SUCCESS AND ORGANOCHLORINE RESIDUES IN LOUISIANA, 1971-1976,
Fish and Wildlife Service, Corvallis, OR. Patuxent Wildlife Research Center.
For primary bibliographic entry see Field 5A.
W79-08047

CLEARANCE OF ARSENIC INGESTED BY MAN FROM ARSENIC CONTAMINATED FISH,
Fisheries and Marine Service, Halifax (Nova Scotia).
For primary bibliographic entry see Field 5A.
W79-08049

POSSIBLE ACCUMULATION OF HEAVY METALS AROUND OFFSHORE OIL PRODUCTION FACILITIES IN THE BEAUFORT SEA,
Bureau of Land Management, Anchorage, AK. Alaska Outer Continental Shelf Office.
T. K. Newbury.
Arctic, Vol. 32, No. 1, p 42-45, 1979. 1 fig, 13 ref.

Descriptors: *Heavy metals, *Path of pollutants, *Bottom sediments, *Bioaccumulation, Beaufort Sea, Offshore platforms, Alaska, Oil, Chromium, Zinc, Cadmium, Lead, Food chains, Food webs, Benthic fauna, Isopods, Amphipoda.

The heavy metals chromium, zinc, cadmium and lead have accumulated in the sediments around some offshore oil rigs. Oil production is now being considered for some nearshore sections of the Beaufort Sea coast. During winter in the Beaufort Sea, heavy metals in the sediments will not be dispersed; the under-ice currents are slow, and some of the bottom is covered by very saline, relatively stagnant water. Heavy metals in the sedi-

ments can probably be assimilated by epibenthic animals in the nearshore region, and then transferred through the food chain to natives who partially subsist on marine animals. (Deal-EIS)
W79-08050

THE ACCUMULATION OF HEAVY METALS IN THE SUBMERGED PLANT (ELODEA NUTTALLII),
Kanagawa Prefectural Environmental Control Center, Yokohama (Japan).
M. Nakada, K. Fukaya, S. Takeshita, and Y. Wada.
Bulletin of Environmental Contamination and Toxicology, Vol. 22, p 21-27, 1979. 4 tab, 3 ref.

Descriptors: *Heavy metals, *Plant physiology, *Absorption, *Bioaccummulation, *Elodea, Aquatic algae, Acids, Ions, *Lead, *Cadmium, *Copper, *Zinc, *Iron, Water chemistry, Water analysis, Chemical analysis, Path of pollutants.

The relationships of enrichment factors and concentration changes of heavy metals in Elodea nuttallii were studied separately and in the presence of phosphoric acid ions. In the first experiment, we studied the relationship between uptake of heavy metals and the concentration in water when E. nuttallii were cultivated separately in the solutions of one of four metals for 30 days. The results indicated that the uptake of heavy metals in the plant increased with increase of the concentrations in water but the enrichment factor decreased. It was seen that the uptake of Pb was greater than that of Cd and Cu and high values of enrichment factors on Pb were confirmed at comparatively low concentration. In the second experiment E. nuttallii was cultivated in the mixed solutions of heavy metals for 30 days. Values of enrichment factor were relatively low in comparison, but the relative ranking of four elements showed same results. It is suggested that the marked decrease of values in Pb and Cd at 0.1 ppm man show synergistic action of these four elements. In the third experiment, we studied the effects of phosphoric acid on the enrichment of heavy metals. The buds of the plant markedly took up heavy metals in comparison with adult bodies of E. nuttallii and the enrichment was increased further when heavy metals at 1.0 ppm coexisted with phosphoric acid at 2.5 ppm. (Deal-EIS)
W79-08051

CYCLICITY OF CLADOCERAN REPRODUCTION AND ITS RELATIONSHIP TO ENVIRONMENTAL FACTORS (REVIEW),
Akademiya Nauk SSSR, Leningrad. Zoologicheskii Inst.
A. V. Makrushin.
Hydrobiological Journal, Vol. 14, No. 2, p 1-6, 1978. 52 ref.

Descriptors: *Reproduction, *Crustaceans, *Biorhythms, *Photoperiodism, *Daphnia, Animal behavior, Animal physiology, Genetics, Adaptation, Animal populations, Growth stages, Insects, Cycles.

An analysis of literature data on the relationship between the mode of reproduction of cladocerans and environmental factors led to the conclusion that this mode is controlled by the duration of daylight. Cladoceran species are of the long-day and short-day type. In the course of female ontogenesis sensitivity to environmental factors controlling the mode of reproduction changes. In some species the mode of reproduction of the female depends on the conditions under which the preceding generation existed. The question of non-environmentally dependent changes in the norm of response to external factors is discussed. The norm of response to those stimuli on which conversion to gamogenesis depends is a heritable character. As a result of its wide variability with a population the cladocerans easily adapt to the specific dynamics of the environment in different bodies of water. The patterns controlling cyclicity in cladocerans and of diapause in insects are similar. (Deal-EIS)
W79-08052

SORPTION OF CADMIUM AND ITS EFFECT ON GROWTH AND THE UTILIZATION OF INORGANIC CARBON AND PHOSPHORUS OF TWO FRESHWATER DIATOMS,
Argonne National Lab., IL. Radiological and Environmental Research Div.
H. L. Conway, and S. C. Williams.
Journal of the Fisheries Research Board of Canada, Vol. 36, p 579-586, 1979. 2 fig, 5 tab, 26 ref.

Descriptors: *Cadmium, *Sorption, *Diatoms, *Bioaccumulation, Toxicity, Growth rates, Carbon, Phosphorus, Nutrients, Path of pollutants, Heavy metals, Photosynthesis, Plant physiology, Cytological studies, Chemical analysis, Bioassay, Asterionella, Fragilaria, Freshwater.

Cadmium was rapidly sorbed Asterionella formosa and Fragilaria crotonensis during the first 5-10 min of exposure (0.05 to approx. 9 micrograms cadmium per liter), followed by a hyperbolic increase in the cellular cadmium content as a function of time. Results obtained from experiments conducted in the light and dark, experiments using live and dead populations, and cellular site location studies imply that the sorption of cadmium by A. formosa is partially an active process, but for F. crotonensis it appears to be passive. Populations of A. formosa exhibited a corresponding decrease in the growth rate as the ambient cadmium concentration was increased from 2 to 9 micrograms per liter. In contrast, the growth rate of F. crotonensis was unaffected at levels ranging from 0.05 to 9 micrograms Cadmium per liter. The utilization of inorganic carbon by A. formosa was unaffected at 4 micrograms Cadmium per liter, but reduced 45% at 9 micrograms Cadmium per liter. The utilization rates of carbon and phosphorus by F. crotonensis were reduced at the lower cadmium concentrations and enhanced at the highest. (Deal-EIS)
W79-08055

IMPACT OF HYPOXIC CONDITIONS IN THE VICINITY OF LITTLE EGG INLET, NEW JERSEY IN SUMMER 1976,
Ichthyological Associates, Inc., Absecon, NJ.
E. V. Garlo, C. B. Milstein, and A. E. Jahn.
Estuarine and Coastal Marine Science, Vol. 8, p 421-432, 1979. 7 fig, 22 ref.

Descriptors: *Dissolved oxygen, *Oxygen requirements, *Mortality, *Aquatic populations, *Echinoderms, *Polychaetes, New Jersey, Benthic fauna, Biological communities, Toxicity, Crustaceans, Clams, Fish behavior, Animal behavior, Fishkill, Water analysis, Little Egg Inlet.

A major kill of marine animals in the New York Bight from July through September 1976 was caused by hypoxic conditions. Its inshore effects were studied in the vicinity of Little Egg Inlet, New Jersey. The macrobenthic community was most severely affected. Echinoderms suffered the greatest mortalities, followed by crustaceans and bivalves. Seven per cent of the Spisula solidissima population was killed. Polychaetes apparently had very low mortalities. Most motile invertebrates and, to a greater extent, fishes were able to avoid the hypoxia. (Deal-EIS)
W79-08056

BLOOD PROPERTIES OF RAINBOW TROUT IN ACUTE HEPATOTOXITY BY CARBON TETRACHLORIDE,
Hiroshima Univ. (Japan). School of Medicine.
Y. Hiraoka, H. Nakagawa, and S. Murachi.
Bulletin of the Japanese Society of Scientific Fisheries, Vol. 45, No. 4, p 527-532, 1979. 4 fig, 4 tab, 25 ref.

Descriptors: *Rainbow trout, *Toxicity, *Carbon tetrachloride, *Histology, Bioassay, Aquiculture, Chemical properties, Chemical analysis, Cytological studies, Fish physiology, Animal pathology, Proteins, Lipids, Biochemistry, Electrophoresis, Liver.

The liver injury caused by carbon tetrachloride (CCL4) injection in the dorsal aorta of rainbow trout, was evaluated by the changes in some blood parameters. Whereas significant changes of plasma constituents by CCL4 injection were accompanied by the appearance of necrotic areas in liver, the hematological values of affected specimens were nearly equal to those of normal ones. The electrophoretic examination showed depression of albumin fraction and lipoproteins in the CCL4 injected specimens. A compensational increase of certain globulin components was also noticed. The plasma lipid level was observed to decrease with increasing dose in those specimens. The decrease of lipid was for the most part accounted for by the decrease of triglyceride fraction. No significant change was observed in the plasma cholesterol level. (Deal-EIS)
W79-08057

EFFECTS OF DDT AND PCB'S ON SURVIVAL OF LAKE TROUT EGGS AND FRY IN A HATCHERY AND IN LAKE MICHIGAN, 1973-1976,
Michigan Dept. of Natural Resources, Marquette. Marquette Fisheries Research Station.
T. M. Stauffer.
Transactions of the American Fisheries Society, Vol. 108, p 178-186, 1979. 7 tab, 15 ref.

Descriptors: *DDT, *Polychlorinated biphenyls, *Toxicity, *Lake trout, Pesticide toxicity, Pesticide residues, Chemical wastes, Fish eggs, Fish reproduction, Mortality, Growth stages, Fry, Lake Michigan, Brown trout, Fish physiology.

To assess the role of DDT and PCB's in reproductive failure of lake trout (Salvelinus namaycush) planted in Lake Michigan, the author compared mortality of eggs (1.41-5.24 micrograms/g DDT, 3.16-9.90 micrograms/g PCB's) and fry from planted Lake Michigan lake trout with that of eggs (0.05-0.20 micrograms/g DDT, 0.20-0.28 micrograms/g PCB's) and fry from hatchery lake trout. In normal hatchery incubation from fertilization to 6 weeks after swim-up, mortality of Lake Michigan trout (mean + or - 95% confidence limits) was 80 + or - 16% as compared to 46 + or - 14% for hatchery lake trout in 1973-1974 and 50 + or - 9% versus 47 + or - 9%, respectively, in 1974-1975. The significantly higher mortality of Lake Michigan than of hatchery lake trout in 1973-1974 was thought due to causes other than DDT or PCB's. Mortality of Lake Michigan lake trout during different stages of development usually was not linearly correlated with DDT and PCB content. During development in enclosures in Lake Michigan from fertilization or the eyed stage, mortality of Lake Michigan lake trout usually was not significantly greater than that of hatchery fish at eye-up, at swim-up, and at 3 weeks after swim-up. In hatchery tests, Lake Michigan fry mortality (65 + or - 6%) was significantly less than that of hatchery fry (89 + - 6%) after 11 weeks of starvation and was the same (53 + or - 11%) versus 61 + or - 11%) when fry were stressed by half rations for 10 weeks in the presence of similar-sized brown trout (Salmo trutta). The bulk of the evidence indicated that DDT and PCB's did not have an effect on early survival of Lake Michigan lake trout. (Deal-EIS)
W79-08062

THE EFFECT OF AEROCOCCUS VIRIDANS (VAR.) HOMARI ON THE OXYGEN BINDING CAPACITY OF HEMOCYANIN IN THE AMERICAN LOBSTER (HOMARUS AMERICANUS),
Maine Univ. at Orono.
J. H. Rittenburg, M. L. Gallagher, R. C. Bayer, and D. F. Leavitt.
Transactions of the American Fisheries Society, Vol. 108, p 172-177, 1979. 2 fig, 2 tab, 17 ref.

Descriptors: *Lobsters, *Infection, *Pathogenic bacteria, *Gaffkemia, Aquiculture, Commercial shellfish, Animal pathology, Bacteria, Toxicity, Mortality, Proteins, Chemical analysis, Spectrophotometry, Animal physiology, Respiration, Oxygen.

The effect of gaffkemia (Aerococcus viridans) infection on the oxygen binding capacity of the hemocyanin component of the American lobster's hemolymph was examined both in vivo and in vitro. Spectrophotometric and electrophoretic ex-

amination of the hemocyanin indicated that accompanying gaffkemia infection was a 50% reduction in the oxygen binding capacity of the hemocyanin. Serum protein levels were unaffected by the infection. In vitro growth of A. viridans in lobster sera resulted in similar findings. Death from gaffkemia may be a result of hypoxia arising from bacterial impairment of the lobster's respiratory exchange system, rather than a result of nutrient depletion as has previously been reported. (Deal-EIS)
W79-08063

CRASSOSTREA VIRGINICA AS AN INDICATOR OF LEAD POLLUTION,
Environmental Research Lab., Narragansett, RI.
For primary bibliographic entry see Field 5A.
W79-08064

ENVIRONMENTAL EFFECTS OF WESTERN COAL SURFACE MINING PART III - THE WATER QUALITY OF TROUT CREEK, COLORADO,
Colorado State Univ., Fort Collins. Dept. of Chemistry.
R. K. Skogerboe, C. S. Lavallee, M. M. Miller, and D. L. Dick.
Report No. EPA-600/3-79-008, 1979. 68 p, 20 fig, 8 tab, 13 ref.

Descriptors: *Mine drainage, *Streams, *Coal mine wastes, *Strip mine wastes, *Selenium, *Arsenic, Metals, Water quality, Mine wastes, Strip mines, Spoil banks, Calcium, Sulfate, Iron, Manganese, Zinc, Colorado, Trout Creek, Mine spoil drainage.

Water quality parameters have been measured at several on-stream and off-stream sites along Trout Creek, which is recipient of water from coal strip-mining operations. Levels of the gross parameters (e.g., specific conductivity), the common ions (e.g., calcium and sulfate), and some trace components (e.g., selenium) are highest in mine spoil drainages. The impact of the mine spoil drainage on the stream is reflected in the larger quantities of dissolved solids and common ions found at on-stream sites adjacent to and below the mine. Increases in stream concentrations of Mn and Se due to mine inflow can be inferred from the data. Higher concentrations of As, Fe, Mn, Se, and Zn are found in waters draining mine spoils. In the mine spoils, variations in the concentrations of these elements occur with spoil age; more Mn and Zn occur in older spoils, while higher levels of As, Fe, and Se are found in newer spoils. Chemical equilibrium calculations indicate that alkaline precipitation processes can maintain the low concentrations of Al, Cd, Cu, Fe, Pb, and Zn. The general alkaline characteristics of western streams and aquifers suggests that such precipitation equilibria will limit the soluble heavy metal concentrations. (Deal-EIS)
W79-08068

RAPID APPRAISAL OF THE EFFECTS OF VARIOUS SUBSTANCES ON MICROORGANISMS,
Institut National de Recherche Chimique Appliquee, Vert-le-Petit (France).
P. H. Brouzes, A. DePierrefeu, J. Y. Bernhard, and C. Racle.
Progress in Water Technology, Vol. 10, No. 5-6, p 715-725, 1978. 9 fig, 9 ref.

Descriptors: *Analytical techniques, *Digital computers, Computer programming, Research equipment, Automation, Microorganisms, Cytological studies, Waste treatment, Dissolved oxygen, Biodegradation, Industrial wastes, Pollutant identification, Methodology.

In order to forecast the effects of the many substances discharged to treatment plants and natural environments it is advisable to have speedy methods available. A digital computer was used to process automatically a set of microorganism cultures whose respiration was recorded in the presence of the substances studied. It is possible in this way to evaluate inhibiting effects as well as nutrient value or stimulating effects. The method is reproducible and it enabled (production of proteins), to be treated by conventional methods, to be destroyed or treated by other processes in view of their harmful effects on the microflora of waste treatment plants. (Deal-EIS)
W79-08071

EFFECTS OF PH ON THE BIOLOGY AND DISTRIBUTION OF EPHEMERELLA FUNERALIS (EPHEMEROPTERA),
Cornell Univ., Ithaca, NY. Dept. of Entomology and Limnology.
S. B. Fiance.
Oikos, Vol. 31, p 332-339, 1978. 8 fig, 3 tab, 38 ref.

Descriptors: *Hydrogen ion concentration, *Mayflies, Aquatic insects, Life history studies, Fecundity, Food habits, Growth rates, Distribution patterns, Reproduction, Growth stages, Larval growth stage, Acidic water, Life cycles.

The life history, emergence, sex ratio, fecundity, food habits, microhabitat, distributional pattern, and effects of experimental acidification on the emergence, growth, and recruitment of Ephemerella (Eurylophella) funeralis McD. are reported. E. funeral is the only member of the Ephemerellidae known to have a two-year cycle. Larval sex ratio from all study sites was approximately one male for every eight females. Sex ration of adults was found to be side dependent, with males increasing in representation as stream size decreased. The average number of eggs per female was 1853 plus or minus S.E. 87. Facultative parthenogenesis is indicated by the successful development of 53% of 381 eggs taken from an unmated female subimago. Larvae were found in accumulations of organic matter in slower flowing portions of streams and also in permanent woodland pools. Gut contents of larvae were predominantly composed of detritus and decomposing higher plant matter, especially leaves, and fungal growth of submerged wood. E. funeralis appears to decrease in abundance with decreasing stream pH and decreasing organic matter. The experimental acidification of Norris Brook had no effect on the emergence of adults but caused a decrease in growth and nearly eliminated recruitment of the new cohort. A direct relationship between pH and the abundance of E. funeralis in the Hubbard Brook watershed is indicated by the results. (Deal-EIS)
W79-08072

DYNAMICS OF ZINC-65 SPECIFIC ACTIVITY AND TOTAL ZINC IN BENTHIC FISHES ON THE OUTER CONTINENTAL SHELF OFF CENTRAL OREGON,
Oregon State Univ., Corvallis. School of Oceanography.
For primary bibliographic entry see Field 5A.
W79-08075

UPTAKE AND LOSS OF RADIOACTIVE CADMIUM BY THE SEA-SKATER HALOBATES ROBUSTUS (HETEROPTERA: GERRIDAE),
Institut fuer Meeresforschung, Bremerhaven (Germany, F.R.).
For primary bibliographic entry see Field 5A.
W79-08076

INDIVIDUAL EFFECTS AND INTERACTIONS OF SALINITY, TEMPERATURE, AND ZINC ON LARVAL DEVELOPMENT OF THE GRASS SHRIMP PALAEMONETES PUGIO. I. SURVIVAL AND DEVELOPMENTAL DURATION THROUGH METAMORPHOSIS,
Texas A and M Univ., College Station. Dept. of Biology.
C. L. McKenney, Jr., and J. M. Neff.
Marine Biology, Vol. 52, p 177-188, 1979. 2 fig, 5 tab, 57 ref.

Descriptors: *Salinity, *Water temperature, *Zinc, *Shrimp, *Growth rates, *Palaemonetes, Toxicity, Larval growth stage, Heavy metals, Resistance, Life cycles, Animal physiology, Estuaries, Aquatic populations.

Larvae of the estuarine grass shrimp were reared from hatch through successful completion of metamorphosis in 80 combinations of salinity (3 to 31%), temperature (20 degrees to 35 degrees C), and zinc (0.00 to 1.00 ppm). Outside the optimal salinity-temperature conditions of 17 to 27% S and 20 to 27 degrees C, viability of larvae was reduced by both the individual effects of salinity and temperature and interactions between the two factors. Survival capacity of larvae and resistance adaptations to salinity and temperature were progressively reduced by zinc concentrations from 0.25 to 1.00 ppm Zn. Response-surface analysis of the data suggested that the duration of total larval development of P. pugio was least at salinities from 18 to 23% and at temperatures from 30 degrees to 32 degrees C. At both higher and lower salinity-temperature conditions and in increasing zinc concentrations from 0.25 to 1.00 ppm Zn, developmental rates were retarded. A significant zinc-temperature interaction existed, whereby increasing zinc concentrations reduced both survival and developmental rates of larvae more at suboptimal temperatures. Larval resistance to zinc toxicity was least at supraoptimal salinities, indicative of a significant zinc-salinity interaction. The reduced viability, restricted euryplasticity, and retarded developmental rates of P. pugio larvae developing in media with low-level zinc contamination would limit the distributive properties of the pelagic phase in the life cycle of the species and reduce recruitment both into and out of the parent estuarine population. (Deal-EIS)
W79-08077

EFFECTS OF SUSPENDED SEDIMENTS ON PHOTOLYSIS RATES OF DISSOLVED POLLUTANTS,
Environmental Research Lab., Athens, GA.
G. C. Miller, and R. G. Zepp.
Water Research, Vol. 13, p 453-459, 1979. 3 fig, 4 tab, 13 ref.

Descriptors: *Ultraviolet radiation, *Suspended solids, *Euphotic zone, *Photolysis, Solar radiation, Chemical reactions, Absorption, Turbidity, Wavelengths, Degradation(Decomposition), Energy transfer.

Data are presented concerning the effects of suspended sediments upon photolysis rates of dissolved ultraviolet (u.v.) absorbing pollutants. The malachite green leucocyanide actinometer was found to be a convenient and sensitive device for measurement of solar u.v. radiation (approx. 330 nm) in sediment suspensions. Irradiance measurements by the actinometer were employed to compute diffuse attenuation coefficients for sediment suspensions from six natural water bodies in Georgia, Mississippi, and Montana. Specific attenuation coefficients were remarkably similar for all the sediments examined. Evidence is presented that large underestimates of photolysis rates result when beam attenuation coefficients of turbid water bodies are employed to compute the effects of light attenuation. Finally, it is demonstrated that photolysis rates within the photic zone are generally more rapid in turbid than in clear water. Enhanced photolysis rates in turbid waters are attributed to the increased diffuseness of light caused by scattering. (Deal-EIS)
W79-08080

POLONIUM-210 AND LEAD-210 IN MARINE FOOD CHAINS,
International Lab. of Marine Radioactivity, Monte Carlo (Monaco). Oceanographic Museum.
For primary bibliographic entry see Field 5A.
W79-08082

TRANSFER OF MERCURY FROM FISH CARCASS TO FORMICA AQUILONIA (HYMENOPTERA, FORMICIDAE),
Helsinki Univ. (Finland). Dept. of Environmental Conservation.
For primary bibliographic entry see Field 5A.
W79-08084

SOURCES OF POLLUTION FROM AGRICULTURAL DRAINAGE,
California Regional Water Quality Control Board,

Sacramento. Central Valley Region.
R. E. Merrill, R. M. Van De Pol, and W. E. Ryley.
Journal of the Irrigation and Drainage Division, American Society of Civil Engineers, Vol. 105, No. IR2, Proceedings Paper 14605, p 137-145, June 1979. 2 fig, 3 tab, 3 ref, 1 append.

Descriptors: *Water pollution sources, *Water quality, *Agriculture, *California, Irrigation, Drainage, Management, Salinity, Suspended solids, Pollutants, Path of pollutants, Monitoring, Permits, Water pollution, Regulation, Rivers, Flow, Streamflow, Legislation, Federal laws.

In response to Public Law 92-500, a National Pollutant Discharge Elimination System (NPDES) permit program for irrigated agriculture was developed by California in 1974. Approximately 3,000,000 acres (1,200,000 ha) are now under permit. The NPDES permit contains a self-monitoring program that is carried out by water purveying and drainage organizations. Monitoring during the first 2 yr was limited to measurements of flow, salinity, and suspended solids for supply and discharge waters. The information provided by the monitoring program has provided baseline data for surface waters utilized by irrigated agriculture. Since some agricultural discharges have been shown to exceed water quality 'objectives' of surface waters in California, best management practices are being developed in pollution control. Sediment problems are being dealt with by 208 planning sediment control programs, while salinity discharge problems are being considered by the Inter-Agency Drainage Program and may also be handled in some areas by 208 planning. (Sims-ISWS)
W79-08094

ENVIRONMENTAL CHEMISTRY OF COPPER IN LAKE MONONA, WISCONSIN,
Texas Univ. at Dallas, Richardson. Center for Environmental Studies.
I. Sanchez, and G. F. Lee.
Water Research, Vol. 12, No. 10, p 899-903, 1978, 6 fig, 1 tab, 10 ref.

Descriptors: *Environmental effects, *Copper, *Water pollution, Water quality, Water chemistry, Aquatic life, Weed control.

The purpose of this study was to investigate the environmental fate of copper added to Lake Monona for algae control. The lake is thermally stratified in midsummer. Copper concentrations in the epilimnion were about 4 microg/l and in the hypolimnion about 0.3 microg/l. It was concluded that addition of large amounts of copper has not resulted in build-up in the water column primarily due to the precipitation of copper as a basic carbonate under oxic conditions. Under anoxic conditions, soluble copper appears to be limited by sulfide. The sediments have acted as a sink for the added copper. It was concluded that the copper content of the water column is smaller than any concentration known to have significant adverse effects on aquatic life. (Chilton-ORNL)
W79-08129

SOME PROBLEMS OF THE METHOD OF MEASUREMENT OF HYDROCHEMICAL ELEMENTS BY AUTOMATIC STATIONS,
L. B. Kim, S. F. Yudin, and L. L. Solodov.
Soviet Hydrology: Selected Papers, Vol. 16, No. 3, p 224-226, 1977. 5 fig, 2 ref. Translated from Ekspress-Informatsiya, Gidrologiya Sushi, No. 2 (49), p 1-7, 1977.

Descriptors: *Water chemistry, *Measurement, *Automation, *Correlation analysis, Sampling, Water temperature, Hydrogen ion concentration, Dissolved oxygen, Turbidity, Reservoirs, Water quality, Statistics, Data processing.

The planning and development of a surface water quality control system raise some questions regarding the method of measurement and analysis of physicochemical parameters in bodies of water. Along with the problem of determining the optimum times of measurements and their necessary and sufficient accuracy, there are other problems associated with determination of the permissible loss of information on one or several elements and its recovery. The optimum times and accuracy of measurements can be determined from a spectral analysis of measurements of hydrochemical elements made at much smaller intervals than those prescribed by the standard program of operation of the planned system. In that way, one can obtain the distribution of the dispersion of the hydrochemical process from the frequency bands of the spectrum and determine the frequency starting from which the fluctuations of the process can be perceived as noise. (Sims-ISWS)
W79-08146

GREAT LAKES WATER QUALITY, SIXTH ANNUAL REPORT, APPENDIX D: RADIOACTIVITY SUBCOMMITTEE REPORT,
Report to the Implementation Committee, Great Lakes Water Quality Board, July 1978. 78 p, 6 fig, 28 tab, 25 ref, 2 append.

Descriptors: *Water quality, *Great Lakes, *Radioactivity, *Radioactivity effects, Tritium, Strontium, Cesium, Fallout, Water pollution sources, Uranium, Mining wastes, Lake Michigan, Lake Huron, Lake Erie, Lake Ontario, International Commission on Radiological Protection.

Detailed information and data available as of May 1978 concerning radioactivity in the Great Lakes Basin are presented. During 1977 the levels of radionuclides in Lakes Michigan, Huron, Erie, and Ontario were monitored in the open lakes, in nearshore waters, and at municipal water intakes. Most of the radioactivity detected comes from nuclear weapons testing fallout, except for 226Ra which occurs naturally and is occasionally heightened by uranium mining and refining operations. The concentrations measured in 1977 were low and similar to those found in 1976. Occasional transient increases in 3H and 137Cs levels were detected near the discharges of two nuclear power stations. The levels of 137Cs in Lake Ontario fish correlate with the water levels. Concentration of 226Ra at the mouth of the Serpent River, which drains the Elliot Lake uranium mining area decreased slightly over the past year, but the river remains a problem area, because the 226Ra level exceeds Ontario's criterion of 3 pCi/1. Strontium 90 (90Sr) is the major contributor to radiological dose committment in Great Lakes water. The calculated dose from 90Sr decreased markedly for 1977 due to a major change in the International Commission on Radiological Protection's recommendations for the calculation of dose. The 1976 value averaged 0.4 mrem for all the lakes, and the average for 1977 is 0.07 mrem. (Davison-IPA)
W79-08169

GREAT LAKES WATER QUALITY SIXTH ANNUAL REPORT. APPENDIX C. ANNUAL REPORT OF THE REMEDIAL PROGRAMS SUBCOMMITTEE.
Report to the Implementation Committee, Great Lakes Water Quality Board, July 1978. 251 p, 4 fig, 30 tab, 2 append.

Descriptors: Great Lakes region, *Great Lakes, Water quality standards, Phosphorus, Water pollution sources, *Sewage, Lake Erie, Industrial wastes, *Pulp and paper industry, *Oil industry, *Mineral industry.

The status of US and Canadian efforts to meet Great Lakes water quality standards are reviewed. Changes in federal legislation and regulatory actions are described. Eight hundred and twenty-five point sources are reported of which 50% of the US and 62% of the Canadian met 1977 loading requirements. One hundred and sixty-five dischargers contributed to water quality violations. In the US, 63% of the 1971 sewered population was provided with adequate treatment, while 99% of the same Canadian population was provided with adequate treatment. Canadian municipal phosphorus loadings have decreased, and Detroit continues to be the greatest contributor by discharging nearly 60% of the Lake Erie phosphorus load. Disposal of municipal sewage causes problems including air pollution, odor, costs, energy requirements, sludge toxicity, and lack of land available for land disposal. Pollution control programs in three industrial categories are reviewed: pulp and paper, iron and steel, and petroleum refineries. All have produced pollution reductions. (Small-FIRL)
W79-08170

THE MISSOURI BASIN REGION'S WATER QUALITY PLANNING STRATEGY PLANNING DOSSIER. SECOND EDITION.
Federal Water Quality Control Administration, Washington, DC.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-258 273, Price codes: A06 in paper copy, A01 in microfiche. Report June 1970. 98 p, 1 append.

Descriptors: *Water quality, *Water resources development, *River basin development, *Missouri River Basin, *Water pollution, *Water pollution sources, *Water resources planning, Water supply development, Water supply, Recreation demand, Regional development, Planning, Comprehensive planning, Resources, Water use, Consumptive use.

This report delineates a strategy for water planning for the Missouri River Basin of Colorado, Iowa, Kansas, Minnesota, Missouri, Montana, Nebraska, North Dakota, South Dakota and Wyoming. The objectives include identification of significant water problems, establishment of a priority ranking system for water projects, determination of priority based on such a ranking system, assignment of responsibilities for planning to the proper level of government (i.e., Federal, state or local), provision of guidance in focusing upon special water resource problems, creation of a basin information system, outlining the Region's short- and long-range project work schedule, and outlining the general approach to be taken in all basin planning activities. As of 1965, irrigation and steam-electric power accounted for 90% of water use in the basin, while irrigation and livestock accounted for 96% of water consumption. Serious causes of water pollution within the Missouri Basin Region include animal waste pollution, siltation, salinity from agriculture, and general agricultural runoff. Sub-basins within the Missouri system were ranked in order of need for management by an Environmental Multiplier Index (EMI) from a high of 5 (streams with a low level of pollution and high level of use) to a low of 1 (low level of both pollution and use). Recurring problems identified in many individual basins included pollution of streams from recreation growth, industrial waste discharge, sedimentation and erosion, and irrigation return flows. Forty-four projects were ranked in order of planning priority. The report recommends full integration of its proposed strategy with local government planning programs within the basin. (Arnold-NC)
W79-08174

OIL DETECTOR,
D. M. B. Brown.
U.S. Patent No. 4,137,495, 4 p, 6 fig, 7 ref; Official Gazette of the United States Patent Office, Vol. 978, No. 5, p 1859, January 30, 1979.

Descriptors: *Patents, *Oil pollution, *Water pollution sources, Water pollution control, Oily water, Pollutant identification, Equipment, Electrodes, Oil detection.

An oil detector comprises a pair of liquid electrodes having a capillary channel between them of such a size that water and oil will be held there by surface tension, and means for electrically connecting the electrodes to a measuring circuit. In use, the detector is connected to a measuring circuit capable of responding to changes in the electrical resistance between the electrodes. When the detector is then placed, immersed in but adjacent the surface of, water free from oil, the channel becomes filled with water and current can flow between the electrodes. The change in the resistance between the electrodes is detected by a measuring circuit and used to activate a warning system. (Sinha-OEIS)
W79-08230

ENRICHMENTS OF ZINC, LEAD, AND COPPER IN RECENT SEDIMENTS OF WINDERMERE, ENGLAND,
Lancaster Univ., Bailrigg (England). Dept. of Environmental Sciences.
J. Hamilton-Taylor.
Environmental Science and Technology, Vol. 13, No. 6, p 693-697, June 1979. 1 fig, 2 tab, 34 ref.

Descriptors: *Metals, *Heavy metals, *Sediments, *Lake sediments, Pollutants, Pollutant identification, Sampling, Cores, Chemical analysis, Zinc, Lead, Copper, Aluminum, Sulfur, Iron, Manganese, Water pollution, Water pollution sources, Path of pollutants, *Windermere(England).

The concentrations of Zn, Pb, Cu, Al, S, Fe, and Mn were determined in sediment cores from Windermere, N. W. England. Zn, Pb, and Cu are greatly enriched in sediments deposited during the last 130 years. Maximum concentrations were 1180 ppm of Zn, 589 ppm of Pb, and 140 ppm of Cu compared to baseline concentrations of 160, 56, and 24 ppm, respectively. Known sedimentation rates have been used together with the measured concentrations to calculate fluxes of the 3 metals into the lake sediments. Present-day anthropogenic fluxes (total - baseline) were estimated to be 16.9, 9.9, and 1.8 microgram/sq cm/yr for Zn, Pb, and Cu, respectively. Metal sources and transport mechanisms within the lake were discussed, where possible quantitatively. It appears that atmospheric supply of the metals and uptake by diatoms may be important factors in controlling sediment concentrations. (Sims-ISWS)
W79-08257

STUDIES ON THE SEDIMENT OF ST. MARGARET'S BAY, NOVA SCOTIA,
Bedford Inst. of Oceanography, Dartmouth (Nova Scotia). Marine Ecology Lab.
For primary bibliographic entry see Field 2L.
W79-08267

COMBINED SEWER OVERFLOW QUALITY FROM TREATMENT PLANT DATA,
Manhattan Coll., Bronx, NY. Environmental Engineering and Science Program.
J. A. Mueller, and A. R. Anderson.
Journal of the Water Pollution Control Federation, Vol. 51, No. 5, p 958-973, May 1979. 13 fig, 8 tab, 14 ref. NOAA 04-6-002-44027.

Descriptors: *Combined sewers, *Overflow, *Treatment facilities, *Model studies, *New York, Mathematical models, Pollutants, Runoff, Precipitation(Atmospheric), Rainfall, Sewers, Storm runoff, Suspended solids, Biochemical oxygen demand, Data processing, Analytical techniques, Water pollution, Water pollution sources, Path of pollutants.

An indirect method of estimating urban stormwater runoff and overflow loads and concentrations from combined sewer systems was presented. A mathematical framework consisting of mass and flow balances for the sewer system and its attendant treatment plant was used with treatment plant sampling data and rainfall data as input. The mass balance was applied to the drainage area of the 26th Ward Water Pollution Control Plant, Brooklyn, New York. Data on suspended solids, volatile suspended solids, and total and soluble biochemical oxygen demand for 7 selected years were analyzed in depth. Mean annual values of load and concentration were compared with others' directly sampled runoff and overflow data. Sensitivity of model results to variations in input parameters was checked. (Sims-ISWS)
W79-08270

DETERMINATION OF HEAVY METALS AND SELENIUM IN FISH FROM UPPER AUSTRIAN WATERS -- PART 2: LEAD, CADMIUM, SCANDIUM, CHROMIUM, COBALT, IRON, ZINC AND SELENIUM (IN GERMAN),
Oesterreichische Studiengesellschaft fuer Atomenergie G.m.b.H., Seibersdorf. Inst. fuer Biologie.
For primary bibliographic entry see Field 5A.
W79-08276

EFFECTS OF ORAL ADMINISTRATION OF CADMIUM ON FISH - IV EFFECTS ON ULTRASTRUCTURES OF HEPATIC AND RENAL CELLS OF THE CARP AND THE PORGY,
Kyushu Univ., Fukuoka (Japan). Dept. of Fisheries.
For primary bibliographic entry see Field 5A.
W79-08277

THE DOMINANCE OF NANOPLANKTON AS AN INDICATOR OF MARINE POLLUTION: A CRITIQUE,
California Univ., San Diego. La Jolla. Inst. of Marine Resources.
For primary bibliographic entry see Field 5A.
W79-08288

EFFECTS OF THE SPAWNING MIGRATION OF THE ALEWIFE, ALOSA PSEUDOHARENGUS, ON FRESHWATER ECOSYSTEMS,
Rhode Island Univ., Kingston. Graduate School of Oceanography.
A. G. Durbin, S. W. Nixon, and C. A. Oviatt.
Ecology, Vol. 60, No. 1, p 8-17, 1979. 4 fig, 9 tab, 42 ref.

Descriptors: *Nutrients, *Ecosystems, *Fish migrations, *Spawning, *Alewife, *Alosa, Phytoplankton, Eutrophication, Phosphorus, Nitrogen, Respiration, Lakes, Rhode Island, Productivity.

The influx of large numbers of alewife into relatively small freshwater systems may have a considerable impact upon pre-established food chains and nutrient cycles. In tank experiments using pond microcosms, the initial response to the addition of the fish was a large phytoplankton bloom and an increase in litter respiration. The phytoplankton bloom was short-lived, and the most lasting supply of insect and benthic invertebrate food for young fish. The respiration rate of autumn leaves incubated in alewife streams during the migration was significantly higher than that of leaves incubated simultaneously in a stream which had no alewife run. Respiration rates of leaves incubated in the same streams before the arrival of alewives did not differ significantly. The increase in litter respiration, and an indication of microbial and invertebrate activity on the leaf surface, was attributed to the additional nutrients supplied by the fish. (Deal-EIS)
W79-08289

MERCURY POLLUTION OF THE MARINE ENVIRONMENT IN THE REGION OF MARSEILLE, MEDITERRANEAN, FRANCE. PART 3-DEGREE OF CONTAMINATION BY MERCURY OF THE ECHINODERMS LIVING IN THE KELP BEDS IN THE VICINITY OF THE LARGE SEWER OF THE CITY OF MARSEILLES, (IN FRENCH),
Aix-Marseille-2 Univ. (France). Sciences de la Mer et de l'Environment.
For primary bibliographic entry see Field 5A.
W79-08290

RELEASE OF TRACE METALS BY SEWAGE SLUDGE AND THE SUBSEQUENT UPTAKE BY MEMBERS OF A TURTLE GRASS MANGROVE ECOSYSTEM,
Harbor Branch Foundation, Inc. Fort Pierce, FL.
For primary bibliographic entry see Field 5A.
W79-08296

CONCENTRATION OF SILVER 110M IN A MARINE FOOD CHAIN. II. UPTAKE THROUGH THE FOOD CHAIN,
Nantes Univ. (France). Lab. de Biologie Marine.
J-C. Amiard.
Cahiers de Biologie Marine, Vol. 22, p 189-199, 1979. 3 fig, 4 tab, 17 ref.

Descriptors: *Food chains, *Absorption, *Trophic level, *Silver, *Bioaccumulation, Primary productivity, Secondary productivity, Crabs, Diatoms, Water chemistry, Metals, Path of pollutants.

The transfer of silver 110m through a natural marine food chain was studied experimentally. Silver 110m concentration decreased as the level in the productivity pyramid was higher and transfer factors between two successive trophic levels (f.t.) were low: 0.004 between Diatomae and Scrobicularlae, 0.128 between Scrobicularlae and Crabs. However transfer factors between water and the trophic level considered (F.T.) were always above 1: 8.1 for Scrobicularlae, 1.04 for Crabs. The mean percentage assimilated after each meal was 50 per cent and 65 per cent for Scrobicularlae and Crabs respectively. Fecal excretion prevailed (26-28 per cent). There did not seem to be any regulation of silver 110m by the various species studied. Scrobicularlae and Crabs retained 5 per cent and 12 per cent respectively of silver 110m supplied by all the meals. (Deal-EIS)
W79-08306

ALTERATION IN ENZYME ACTIVITIES IN LIVER AND KIDNEY OF CHANNA PUNCTATUS EXPOSED TO ENDRIN,
D.A.V. Coll., Muzaffarnagar (India). Dept. of Zoology.
S. K. Sharma, and K. V. Sastry.
Bulletin of Environmental Contamination and Toxicology, Vol. 22, p 17-20, 1970. 1 tab, 15 ref.

Descriptors: *Enzymes, *Endrin, *Pesticide toxicity, *Tissue analysis, *Channa, Pesticide residues, Chlorinated hydrocarbon pesticides, Toxicity, Inhibition, Biochemistry, Fish physiology, Animal metabolism, Chemical analysis, Bioassay.

The fish were treated with a sub-lethal concentration (0.01 mg/L) of endrin for 30 days in tap water. After the exposure period the liver and kidney were assayed for the following enzymes: alkaline phosphatase; acid phosphatase; glucose-6-phosphatase; x-smylase and lipase. The activities of all three phosphatases and the lipase in the liver was inhibited by treatment of fishes by endrin. In contrast to liver, the three phosphatases showed a slight elevation in activity in the kidney. However, the stimulation of alkaline and acid phosphatases was statistically insignificant. (Deal-EIS)
W79-08312

UPTAKE AND DEPURATION OF PETROLEUM HYDROCARBONS IN THE MANILA CLAM, TAPES SEMIDECUSSATA REEVE,
California Univ., Bodega Bay. Bodega Marine Lab.
For primary bibliographic entry see Field 5A.
W79-08314

ENDRIN TOXICOSIS ON FEW ENZYMES IN LIVER AND KIDNEY OF CHANNA PUNCTATUS (BLOCH),
D.A.V. Coll., Muzaffarnagar (India). Dept. of Zoology.
K. V. Sastry, and S. K. Sharma.
Bulletin of Environmental Contamination and Toxicology, Vol. 22, p 4-8, 1979. 1 tab, 20 ref.

Descriptors: *Endrin, *Pesticide toxicity, *Enzymes, *Channa, *Tissue analysis, Chemical analysis, Fish physiology, Animal metabolism, Inhibition, Biochemistry, Chlorinated hydrocarbon pesticides, Path of pollutants, Teleosts, Phosphatase.

Exposure of fishes for 15 days to endrin in vivo resulted in the inhibition of activities of acid phosphatase and glucose-6-phosphatase in the liver. This is followed by an elevation above normal level in fishes treated for 30 days. In contrast to liver, kidney revealed an increased activity of all the three enzymes at both the experimental periods. At 15 days of exposure, there is no significant change in acid phosphatase activity but kidney showed an elevation in activity. (Deal-EIS)
W79-08315

FURTHER STUDIES ON THE TOXICITY OF DDT TO PLANARIA,
National Council for Scientific Research, Beirut (Lebanon). Marine Research Center.
H. H. Kouyoumjian, and J. P. Villeneuve.
Bulletin of Environmental Contamination and Toxicology, Vol. 22, p 109-112, 1979. 1 fig, 1 tab, 4

ref.

Descriptors: *DDT, *Pesticide toxicity, *Planaria, *Tissue analysis, *Bioaccumulation, Reproduction, Absorption, Animal metabolism, DDD, DDE, Chlorinated hydrocarbon pesticides, Path of pollutants, Chemical analysis, Inhibition, Growth rates, Benthos, Animal pathology, Flat worms.

The paper studies the possible deleterious effects of DDT on regeneration and asexual fission, and looks briefly into the rate of absorption and metabolism of DDT by normal and regenerating (decapitated) planaria. Concentrations of 0.15 ppm DDT had an inhibitory effect on asexual fission during a 14-day trial. Regenerating planaria were able to resist DDT absorption during the first 24-h of exposure. After this period, planaria absorb DDT at an increased rate. DDT absorption by regenerating planaria appears to slow down the rate of regeneration. Both normal and regenerating planaria could metabolize DDT and DDE. DDE was found to be the major metabolite. (Deal-EIS)
W79-08316

A COMPARATIVE STUDY OF THE EFFECT OF ACUTE AND CHRONIC MERCURIC CHLORIDE TREATMENT ON THE ACTIVITIES OF A FEW DIGESTIVE ENZYMES OF A TELEOST FISH, CHANNA PUNCTATUS,
D.A.V. Coll., Muzaffarnagar (India). Dept. of Zoology.
For primary bibliographic entry see Field 5A.
W79-08319

ALKANES IN FISH FROM THE BUCCANEER OILFIELD,
Houston Univ., TX. Dept. of Biophysical Sciences.
For primary bibliographic entry see Field 5A.
W79-08320

UPTAKE, TISSUE DISTRIBUTION, METABOLISM AND ELIMINATION N-OCTANO-1-14C-HYDROXAMIC ACID BY BROOK TROUT,
Bedford Inst. of Oceanography, Dartmouth (Nova Scotia).
For primary bibliographic entry see Field 5A.
W79-08321

UPTAKE AND METABOLISM OF SELENIUM BY OYSTERS,
Southhampton Univ. (England). Dept. of Oceanography.
For primary bibliographic entry see Field 5A.
W79-08322

MERCURIC CHLORIDE INDUCED ENZYMOLOGICAL CHANGES IN KIDNEY AND OVARY OF A TELEOST FISH, CHANNA PUNCTATUS,
D. A. V. Coll., Muzaffarnagar (India). Dept. of Zoology.
K. V. Sastry, and M. K. Agrawal.
Bulletin of Environmental Contamination and Toxicology, Vol. 22, p 38-43, 1979. 1 tab, 25 ref.

Descriptors: *Mercury, *Enzyme, *Channa, *Tissue analysis, Teleosts, Heavy metals, Fish physiology, Animal metabolism, Inhibition, Chemical analysis, Biochemistry, Lipids, Amino acids, Proteins.

The effect of 1.8 mg/L and a sublethal concentral (0.30 mg/L) of in vivo mercuric chloride exposure on the activities of acid and alkaline phosphatases, glucose-6-phosphatase, lipase and urease in the kidneys and ovaries of a teleost fish, Channa punctatus has been studied after 96 hr and 30 days, respectively. It has been observed that the activities of all the enzymes excepts acidphosphatase were significantly inhibited in both the tissues. However, treatment for 96 hr resulted in more marked inhibition than 30 days of treatment. Acid phosphatase showed elevation in activity in the kidney after 96 hr of treatment. (Deal-EIS)
W79-08323

ACCUMULATION OF POLYCHLORINATED BIPHENYL (PHENOCLOR DP6) BY ESTUARINE FISH,
Bordeaux Univ., Talence (France). Lab. de Physiologie de la Nutrition.
For primary bibliographic entry see Field 5A.
W79-08325

CARP (C1-2) OVERWINTERING AND BREEDING IN COOLING WATERS, (IN POLISH),
Instytut Akwakultury i Techniki Rybackiej, Szczecin (Poland).
For primary bibliographic entry see Field 5C.
W79-08332

EVALUATION OF ITT RAYONIER, INC., OUTFALL PORT ANGELES HARBOR, WASHINGTON,
National Field Investigations Center, Denver, CO.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-255 600, Price codes: A06 in paper copy, A01 in microfiche. December 1974. 105 p, 34 fig, 12 tab, 4 ref, 2 append.

Descriptors: *Water quality, Waste water, *Pulp and paper industry, *Effluents, Diffusion, Ocean currents, Outfall sewers, Remote sensing, Liquid wastes, Juan de Fuca Strait, Port Angeles Harbor(Washington).

A remote sensing study using optical and thermal sensors was conducted to document the dilution or dispersion characteristics of the ITT Rayonier, Inc. pulp and paper mill submerged outfall diffuser effluent. This outfall discharges an ammonia-base hot caustic extract and bleach plant effluent and 20% of the plant's total ammonia-base spent sulfite liquor wasteload. A total of 18,000 to 22,700 kg/day of biochemical oxygen demand (BOD) is discharged by the submerged outfall. The study included five remote sensing flights over Port Angeles Harbor, Washington, for which drogue assemblies were deployed to monitor the current and displacement of water at three pre-selected depths and at the surface. Results of two flights showed that the drogues released near the diffuser moved into the harbor instead of dispersing directly into the Strait of Juan de Fuca according to the diffuser design and location. The plume in the zone of dilution was cooler than the surface temperature of the receiving water, and did not exceed the thermal limitations. From an analysis of the physical and chemical data, and the dispersion and circulation characteristics in the area of the submerged outfall, it is concluded that the predicted performance of this outfall as described in the ITT Rayonier study is incorrect. (Davison-IPA)
W79-08349

REPORT ON FY-78 NUMERICAL MODELING IN THE STRAIT OF JUAN DE FUCA AND PUGET SOUND,
National Oceanic and Atmospheric Administration, Seattle, WA. Pacific Marine Environmental Lab.
NOAA Technical Memorandum ERL MESA-38, February 1979. 35 p, 20 fig, 10 ref.

Descriptors: *Meteorology, *Models, *Oil spills, Tidal effects, Climatology, Oceanography, Washington, Puget Sound, Strait of Juan de Fuca, Tidal currents, Oil spill trajectories.

This report summarizes and interprets tidal current and oil spill trajectory predictions obtained from a computer model of the Strait of Juan de Fuca and regional wind fields derived from a computer model of the entire Puget Basin. The meteorology of the Puget Sound Basin is discussed with respect to three dominant weather patterns which were subsequently used to run the regional meteorological model. These model results are incorporated into oil spill trajectory calculations as large scale wind fields over the Straits which are sequentially keyed by baric types for any given modeling period. A sea breeze condition was also considered and is described in the trajectory modeling section. The oceanography of the Strait of Juan de Fuca region is presented as a discussion of the dominant features, tidal and estuarine flow components, and some possible deviations from these main elements. The tide subroutines constructed for the trajectory model are based on empirical data from NOS tidal current stations and are inline functions to the trajectory model. The principal product of the model was a series of simulated oil spill trajectories. (NOAA)
W79-08379

PUGET SOUND CIRCULATION: FINAL REPORT FOR FY77-78,
National Oceanic and Atmospheric Administration, Seattle, WA. Pacific Marine Environmental Lab.
For primary bibliographic entry see Field 2L.
W79-08380

LEACHATE MIGRATION FROM A PESTICIDE WASTE DISPOSAL SITE IN HARDEMAN COUNTY, TENNESSEE,
Geological Survey, Nashville, TN. Water Resources Div.
C. L. Sprinkle.
Geological Survey Water-Resources Investigations 78-128 (open-file report), 1978. 35 p, 10 fig, 5 tab, 8 ref.

Descriptors: *Underground waste disposal, *Chlorinated hydrocarbon pesticides, *Leachate, *Infiltration rates, *Path of pollutants, Groundwater, Water table aquifers, Water pollution sources, Water analysis, Dieldrin, Endrin, Heptachlor, *Hardeman County(Tenn).

Between 1964 and 1972, approximately 300,000 drums (55-gallon steel barrels) of waste derived from the manufacturing of pesticides were buried on 45 acres of land in northern Hardemen County, Tennessee. Leachates from these wastes are migrating from the disposal site in surface runoff, through shallow perched water zones, and through the local water-table aquifer. Compounds identified in the leachates included: dieldrin, endrin, chlordene, heptachlor, heptachlor epoxide, pentachlorocyclopentadiene, and hexachloro-bicycloheptadiene. The rate of migration of some of the leachate compounds in the water-table aquifer was found to be at least 80 feet per year. (Woodard-USGS)
W79-08392

PROGRESS REPORT ON THE BLACK MESA, ARIZONA, GROUND-WATER MONITORING PROGRAM,
Geological Survey, Flafstaff, AZ. Water Resources Div.
For primary bibliographic entry see Field 4C.
W79-08400

A CONFERENCE OF THE MINERAL ESTATE INCLUDES A TRANSFER OF GEOTHERMAL RESOURCES,
For primary bibliographic entry see Field 6E.
W79-08415

MIXING ZONES (RECOMMENDATIONS FOR A NATIONWIDE STRATEGY FOR WATER QUALITY MANAGEMENT).
Environmental Protection Agency, Washington, DC. Div. of Water Quality Standards.
For primary bibliographic entry see Field 5A.
W79-08428

WILLAMETTE BASIN COMPREHENSIVE STUDY OF WATER AND RELATED LAND RESOURCES: APPENDIX L--WATER POLLUTION CONTROL,
Pacific Northwest River Basins Commission, Portland, OR. Willamette Basin Task Force.
For primary bibliographic entry see Field 5A.
W79-08445

CONTROL OF FOULING ORGANISMS IN ESTUARINE COOLING WATER SYSTEMS BY CHLORINE AND BROMINE CHLORIDE,

Academy of Natural Sciences of Philadelphia, Benedict, MD. Benedict Estuarine Research Lab.
For primary bibliographic entry see Field 5C.
W79-08449

SAFE ZINC AND COPPER LEVELS FROM THE SPRING CREEK STEELHEAD TROUT IN THE UPPER SACRAMENTO RIVER, CALIFORNIA,
California State Dept. of Fish and Game, Rancho Cordova. Water Pollution Control Lab.
For primary bibliographic entry see Field 5C.
W79-08465

MICROBIOLOGICAL CYCLING OF OIL IN ESTUARINE MARSHLANDS,
Georgia State Univ., Atlanta.
For primary bibliographic entry see Field 5C.
W79-08474

5C. Effects Of Pollution

THE EFFECTS OF SALINE IRRIGATION WATER AND GYPSUM ON PERENNIAL PASTURE GROWN ON A SODIC, CLAY SOIL AT KERANG, VICTORIA,
Victoria Dept. of Agriculture, Kerang.
J. H. Mount, and D. L. Schuppan.
Australian Journal of Experimental Agriculture and Animal Husbandry, Vol. 18, No. 93, p 533-538, August 1978, 5 tab, 3 fig, 8 ref.

Descriptors: *Effluents, *Alkaline soils, *Irrigation effects, *Saline water, *Gypsum, Soil-water-plant relationship, Crop response, Australia, Pasture management, Irrigation operation and maintenance, Clays, Irrigation water, Soil properties, Environmental effects.

This study examines the effects of using a range of saline effluents to irrigate clay sodic soils on pasture production in northern Victoria, Australia. During five consecutive growing seasons, 1971-1975, saline effluents of 6000, 4000, 2400, 1600, 800, and 100 mg 1-1 total soluble salt (TSS) were used to irrigate perennial pasture grown on heavy clay sodic soils. Results indicate that (1) after five seasons, there were no significant differences in pasture dry matter yields between the 100 and 800 or 1600 mg 1 TSS treatments, (2) in the fifth season, there were significant five percent higher dry matter yields in the 800 mg 1 TSS treatment compared to the 1600 mg 1 treatment, and (3) when effluents were above 1600 mg 1 TSS treatments, dry matter yields were inversely related to salinity levels. Gypsum applications, included among the various treatments, produced no significant dry matter response in the 4th and 5th seasons, although significant responses at the 10 and 20 t ha-1 application rates were indicated in the 2d and 3d seasons respectively. Lucerne (Medicago sativa), perennial ryegrass (Lolium perenne), and tall wheatgrass (Agropyron elongatum) proved to be valuable pasture species when irrigated with saline water. (Tickes-Arizona)
W79-08020

EFFECTS OF THE TRIAZINE HERBICIDE CYANATRYN ON AQUATIC ANIMALS,
Institute of Terrestrial Ecology, Huntingdon (England). Monks Wood Experimental Station.
H. R. A. Scorgie, and A. S. Cooke.
Bulletin of Environmental Contamination and Toxicology, Vol. 22, p 135-142, 1979. 2 fig, 2 tab, 12 ref.

Descriptors: *Herbicides, *Pesticide toxicity, *Triazine pesticides, *Cyanatryn, *Tadpoles, Organic pesticides, Snails, Daphnia, Frogs, Growth stages, Mortality, Juvenile growth stage, Animal behavior, Animal physiology, Bioassay.

This series of experiments showed that D. pulex and tadpoles of the frog, R. temporaria, are affected by short-term exposure to levels of cyanatryn as low as those recommended for use in the field (0.05 and 0.2 ppm). Lymnaea peregra juveniles showed no adverse effects at these levels, but egg production appeared to be affected. Tadpoles were the most sensitive of the animals tested. When, however, groups of tadpoles were caged in drainage channels and exposed to 0.02 ppm cyanatryn, one tenth of the recommended concentration, there were no detectable effects. (Deal-EIS)
W79-08034

MERCURY CONCENTRATIONS IN THREE SPECIES OF TUNAS COLLECTED FROM VARIOUS OCEANIC WATERS,
National Marine Fisheries Service, Milford, CT. Experimental Biological Investigations.
For primary bibliographic entry see Field 5A.
W79-08035

RELIABILITY OF AQUATIC INSECTS VERSUS WATER SAMPLES AS MEASURES OF AQUATIC LEAD POLLUTION,
Colorado Div. of Wildlife, Montrose.
For primary bibliographic entry see Field 5A.
W79-08036

FATE AND EFFECTS OF CADMIUM IN AN EXPERIMENTAL MARINE ECOSYSTEM,
Biologische Anstalt Helgoland, Hamburg (Germany, F. R.).
For primary bibliographic entry see Field 5A.
W79-08037

DETERMINATION OF THE ABSORPTION OF CR+6 AND CR+3 IN AN ALGAL CULTURE OF CHLORELLA PYRENOIDOSA USING 51CR,
Roskilde Univ. Center (Denmark). Inst. for Environment, Technology and Society.
For primary bibliographic entry see Field 5A.
W79-08038

INVESTIGATION ON THE DISTRIBUTION OF DDT AND AROCLOR 1254 IN LABORATORY-GROWN MARINE PHYTOPLANKTON,
Institut Rudjer Boskovic, Rovinj (Yugoslavia). Center for Marine Research.
For primary bibliographic entry see Field 5A.
W79-08039

MOBILIZATION AND ACCUMULATION OF SEDIMENT BOUND HEAVY METALS BY ALGAE,
Ottawa Univ. (Ontario). Dept. of Biology.
For primary bibliographic entry see Field 5A.
W79-08040

SURVIVAL AND DEVELOPMENT OF ATLANTIC SALMON EGGS AND FRY AT THREE DIFFERENT TEMPERATURES,
Norges Landbrukshoegskole, Vollebekk. Dept. of Animal Genetics and Breeding.
K. Gunnes.
Aquaculture, Vol. 16, p 211-218, 1979. 7 fig, 3 tab, 12 ref.

Descriptors: *Water temperature, *Atlantic Salmon, *Toxicity, Freshwater fish, Fish eggs, Fry, Mortality, Growth rates, Growth stages, Fish reproduction, Embryonic growth stage, Salmonids, Fish physiology, Aquiculture.

Groups of Atlantic salmon (Salmo salar) eggs were incubated at 12, 10 and 8 degrees C. At 12 degrees C mortality was high and fry averaged little more than half the weight of those hatched at 10 or 8 degrees C. Development of alevins to the 'swim-up' stage was also abnormal at 12 degrees C. The results suggest that 10 degrees C is optimal for incubating Atlantic salmon eggs. For the period between hatching and swim-up, the most favourable temperature varies according to the temperature used during incubation. Mortality rate during the first 6 weeks of feeding was correlated with mortality during earlier development. Total numbers of day-degrees required by the eggs and fry to reach the eyed, hatching, and swim-up stages of developmet were significantly less at 12 degrees C than at 10 or 8 degrees C. However, total day-degrees required to reach an average weight of 0.5 - 0.6 g were almost the same regardless of temperature during hatching. (Deal-EIS)
W79-08041

EFFECTS OF HEAVY METALS ON BENTHIC MACROINVERTEBRATE DENSITIES IN FOUNDRY COVE ON THE HUDSON RIVER,
New York Univ. Medical Center, NY. Inst. of Environmental Medicine.
For primary bibliographic entry see Field 5A.
W79-08042

ACUTE TOXICITY OF COPPER, CHROMATE, ZINC, AND CYANIDE TO FRESHWATER FISH: EFFECT OF DIFFERENT TEMPERATURES,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Biology.
For primary bibliographic entry see Field 5B.
W79-08043

THE EFFECT OF THE LIMING OF FISH-BREEDING PONDS ON SOME CRUSTACEAN PLANKTERS,
Ukrainian Research Inst. of the Fish Industry, Kiev (USSR).
For primary bibliographic entry see Field 5A.
W79-08044

TOXIC SUBSTANCES IN THE EFFLUENTS OF PETROCHEMICAL PLANTS AND THEIR EFFECT ON AQUATIC ORGANISMS (REVIEW),
Irkutskii Gosudarstvennyi Univ. (USSR). Scientific Research Inst. of Biology.
For primary bibliographic entry see Field 5B.
W79-08045

ALTERATIONS IN CALCIUM ACCUMULATION BEHAVIOR IN RESPONSE TO CALCIUM AVAILABILITY AND POLYCHLORINATED BIPHENYL ADMINISTRATION,
Southeastern Massachusetts Univ., North Dartmouth. Dept. of Biology.
For primary bibliographic entry see Field 5B.
W79-08046

BROWN PELICAN: POPULATION STATUS, REPRODUCTIVE SUCCESS AND ORGANOCHLORINE RESIDUES IN LOUISIANA, 1971-1976,
Fish and Wildlife Service, Corvallis, OR. Patuxent Wildlife Research Center.
For primary bibliographic entry see Field 5A.
W79-08047

TOXICITY AND TERATOGENICITY OF AROMATIC AMINES TO XENOPUS LAEVIS,
Oak Ridge National Lab., TN.
For primary bibliographic entry see Field 5A.
W79-08048

CLEARANCE OF ARSENIC INGESTED BY MAN FROM ARSENIC CONTAMINATED FISH,
Fisheries and Marine Service, Halifax (Nova Scotia).
For primary bibliographic entry see Field 5A.
W79-08049

POSSIBLE ACCUMULATION OF HEAVY METALS AROUND OFFSHORE OIL PRODUCTION FACILITIES IN THE BEAUFORT SEA,
Bureau of Land Management, Anchorage, AK. Alaska Outer Continental Shelf Office.
For primary bibliographic entry see Field 5B.
W79-08050

THE ACCUMULATION OF HEAVY METALS IN THE SUBMERGED PLANT (ELODEA NUTTALLII),
Kanagawa Prefectural Environmental Control

Center, Yokohama (Japan).
For primary bibliographic entry see Field 5B.
W79-08051

CYCLICITY OF CLADOCERAN REPRODUCTION AND ITS RELATIONSHIP TO ENVIRONMENTAL FACTORS (REVIEW),
Akademiya Nauk SSSR, Leningrad. Zoologicheskii Inst.
For primary bibliographic entry see Field 5B.
W79-08052

A BIOASSAY FOR THE TOXICITY OF SEDIMENT TO MARINE MACROBENTHOS,
Pacific Northwest Environmental Research Lab., Newport, OR. Marine Science Center.
For primary bibliographic entry see Field 5A.
W79-08053

SORPTION OF CADMIUM AND ITS EFFECT ON GROWTH AND THE UTILIZATION OF INORGANIC CARBON AND PHOSPHORUS OF TWO FRESHWATER DIATOMS,
Argonne National Lab., IL. Radiological and Environmental Research Div.
For primary bibliographic entry see Field 5B.
W79-08055

IMPACT OF HYPOXIC CONDITIONS IN THE VICINITY OF LITTLE EGG INLET, NEW JERSEY IN SUMMER 1976,
Ichthyological Associates, Inc., Absecon, NJ.
For primary bibliographic entry see Field 5B.
W79-08056

BLOOD PROPERTIES OF RAINBOW TROUT IN ACUTE HEPATOTOXITY BY CARBON TETRACHLORIDE,
Hiroshima Univ. (Japan). School of Medicine.
For primary bibliographic entry see Field 5B.
W79-08057

THE MARINE ALGAE OF ELIE, SCOTLAND: A RE-ASSESSMENT,
Heriot-Watt Univ., Edinburgh, (Scotland). Dept. of Brewing and Biological Sciences.
For primary bibliographic entry see Field 5A.
W79-08058

RESPIRATORY RESPONSES OF LARGEMOUTH BASS (MICROPTERUS SALMOIDES) TO ENVIRONMENTAL CHANGES IN TEMPERATURE AND DISSOLVED OXYGEN,
California Univ., Davis. Dept. of Wildlife and Fisheries Biology.
For primary bibliographic entry see Field 5A.
W79-08059

EFFECT OF SALINITY AND MANGANESE ON MEDIDOTEA ENTOMON,
All-Union Research Inst. of Marine Fisheries and Oceanography, Moscow (USSR).
For primary bibliographic entry see Field 5A.
W79-08060

AN ENVIRONMENTAL CHAMBER FOR MONITORING 'IN SITU' GROWTH AND SURVIVAL OF LARVAL FISHES,
National Marine Fisheries Service, Narragansett, RI. Narragansett Lab.
For primary bibliographic entry see Field 5A.
W79-08061

EFFECTS OF DDT AND PCB'S ON SURVIVAL OF LAKE TROUT EGGS AND FRY IN A HATCHERY AND IN LAKE MICHIGAN, 1973-1976,
Michigan Dept. of Natural Resources, Marquette. Marquette Fisheries Research Station.
For primary bibliographic entry see Field 5B.
W79-08062

CRASSOSTREA VIRGINICA AS AN INDICATOR OF LEAD POLLUTION,
Environmental Research Lab., Narragansett, RI.
For primary bibliographic entry see Field 5A.
W79-08064

BEHAVIORAL CHANGES IN BLUEGILL (LEPOMIS MACROCHIRUS) AS INDICATORS OF SUBLETHAL EFFECTS OF METALS,
Iowa State Univ., Ames. Dept. of Animal Ecology.
For primary bibliographic entry see Field 5A.
W79-08065

DDT INDUCED ETHOLOGICAL CHANGES IN ESTUARINE FISH,
Centre of Advanced Study in Marine Biology, Porto Novo (India).
For primary bibliographic entry see Field 5A.
W79-08066

EVIDENCE OF WEIGHT-DEPENDENT DIFFERENTIAL HEMATOLOGICAL RESPONSE TO INCREASED ENVIRONMENTAL TEMPERATURE BY CARP, CYPRINUS CARPIO,
Brock Univ., St. Catherines (Ontario). Dept. of Biological Sciences.
For primary bibliographic entry see Field 5A.
W79-08067

ENVIRONMENTAL EFFECTS OF WESTERN COAL SURFACE MINING PART III - THE WATER QUALITY OF TROUT CREEK, COLORADO,
Colorado State Univ., Fort Collins. Dept. of Chemistry.
For primary bibliographic entry see Field 5B.
W79-08068

MALFORMATIONS AND INHIBITORY TENDENCIES INDUCED TO BRACHYDANIO RERIO (HAMILTON-BUCHANAN) EGGS AND LARVAE DUE TO EXPOSURES IN LOW CONCENTRATIONS OF LEAD AND COPPER IONS,
Uppsala Univ. (Sweden). Inst. of Zoology.
P. T. E. Ozoh.
Bulletin of Environmental Contamination and Toxicology, Vol. 21, p 668-675, 1979. 6 fig, 2 tab, 5 ref.

Descriptors: *Lead, *Copper, *Toxicity, *Fish eggs, Mutagens, *Teratogens, *Brachydanio, Embryonic growth stage, Larval growth stage, Mortality, Growth rates, Hatching, Fish physiology, Bioassay, Heavy metals, Water pollution effects.

Brachydanio rerio eggs were exposed to concentrations of 0, 36, and 72 ppb of lead and copper singly or in combination and subsequent development observed. In terms of developmental abnormalities, copper ions induced characteristic spiral malformations of the rhombencephalic region of the nervous system. Lead ions interfered with resorption of yolk in fry, erosion of tail and fin, spinal curvature and epitheliomas. In combined copper-lead experiments the copper malformation was suppressed but not those of lead. Both lead and copper ions also affected successful hatching. (Deal-EIS)
W79-08069

A COMPARISON OF THE TOXICITY OF NICKEL TO THE DEVELOPING EGGS AND LARVAE OF CARP (CYPRINUS CARPIO),
Oak Ridge National Lab., TN. Environmental Sciences Div.
B. G. Blaylock, and M. L. Frank.
Bulletin of Environmental Contamination and Toxicology, Vol. 21, p 604-611, 1979. 1 fig, 3 tab, 18 ref.

Descriptors: *Nickel, *Toxicity, *Carp, Fish eggs, Larval growth stage, Heavy metals, Life cycles, Mortality, Bioassay, Fish physiology, Sulfates, Resistance, Embryonic growth stage.

The objectives of this study were (1) to determine the toxicity of Ni to developing carp eggs and newly hatched carp larvae and (2) to compare the resistance of these two life stages to Ni toxicity. Developing eggs were exposed to selected concentrations of 3-10 ppm NiSo4. Concentrations of up to 4 ppm of Ni had no effect on the hatchability of the eggs. Beyond this level the hatching percentage decreased with increasing Ni concentrations. Carp larvae that hatched from controls were used in the experiments to determine the toxicity of Ni to the larval stage. One-day-old carp larvae were exposed to concentrations of Ni ranging from 1 to 10 ppm. As the Ni concentration increased the % survival figure decreased. The 72-h LC50 for the carp larvae was 8.46 ppm Ni as compared to 6.10 ppm for developing eggs at the time of hatching (72 h). (Deal-EIS)
W79-08070

EFFECTS OF PH ON THE BIOLOGY AND DISTRIBUTION OF EPHEMERELLA FUNERALIS (EPHEMEROPTERA),
Cornell Univ., Ithaca, NY. Dept. of Entomology and Limnology.
For primary bibliographic entry see Field 5B.
W79-08072

STRUCTURE RELATED UPTAKE OF CHLORINATED PARAFFINS IN BLEAKS (ALBURNUS ALBURNUS L),
National Swedish Environment Protection Board, Studsvik (Sweden). Brackish Water Toxicology Lab.
For primary bibliographic entry see Field 5A.
W79-08073

SPECIFIC AND NONSPECIFIC CHANGES INDUCED IN FISH BY VARIOUS TOXIC AGENTS,
Akademiya Nauk URSR, Kiev. Inst. Hidrobiologii.
For primary bibliographic entry see Field 5A.
W79-08074

DYNAMICS OF ZINC-65 SPECIFIC ACTIVITY AND TOTAL ZINC IN BENTHIC FISHES ON THE OUTER CONTINENTAL SHELF OFF CENTRAL OREGON,
Oregon State Univ., Corvallis. School of Oceanography.
For primary bibliographic entry see Field 5A.
W79-08075

UPTAKE AND LOSS OF RADIOACTIVE CADMIUM BY THE SEA-SKATER HALOBATES ROBUSTUS (HETEROPTERA: GERRIDAE),
Institut fuer Meeresforschung, Bremerhaven (Germany, F.R.).
For primary bibliographic entry see Field 5A.
W79-08076

INDIVIDUAL EFFECTS AND INTERACTIONS OF SALINITY, TEMPERATURE, AND ZINC ON LARVAL DEVELOPMENT OF THE GRASS SHRIMP PALAEMONETES PUGIO. I. SURVIVAL AND DEVELOPMENTAL DURATION THROUGH METAMORPHOSIS,
Texas A and M Univ., College Station. Dept. of Biology.
For primary bibliographic entry see Field 5B.
W79-08077

THE EFFECT OF NUTRITION ON THE RESPONSE OF FIELD POPULATIONS OF THE CALANOID COPEPOD ACARTIA TONSA TO COPPER,,
Environmental Research Lab., Narragansett, RI.
For primary bibliographic entry see Field 5A.
W79-08079

THE EFFECTS OF MONOCHLORAMINE ON SELECTED RIVERINE FISHES,
Wisconsin Univ.-Milwaukee. Dept. of Zoology.
For primary bibliographic entry see Field 5A.

W79-08081

POLONIUM-210 AND LEAD-210 IN MARINE FOOD CHAINS,
International Lab. of Marine Radioactivity, Monte Carlo (Monaco). Oceanographic Museum.
For primary bibliographic entry see Field 5A.
W79-08082

INFLUENCE OF THREE SEDIMENT TYPES ON COPPER TOXICITY TO THE POLYCHAETE NEANTHES ARENACEODENTATA,
Environmental Research Lab. Narragansett, RI.
C. E. Pesch.
Marine Biology, Vol. 52, p 237-245, 1979. 6 fig, 4 tab, 19 ref.

Descriptors: *Copper, *Toxicity, *Sediments, *Worms, *Polychaetes, *Tissue analysis, Chemical analysis, Bioassay, Sands, Particle size, Mud, Mortality, Animal physiology, Animal metabolism.

Adult male Neathes arenaceodentata were exposed to 0.10 plus or minus 0.015 mg/1 copper in the seawater of a continuous-flow bioassay system in the presence of a sand, a mud, a mixture of the sand and mud, and no sediment, to assess the influence of sediment type on Cu-induced mortality. The sediment type did influence mortality. The time to 50% mortality was 7.8 days without sediment, 36.5 days with sand, 54.5 days with the mixture, and 50.0 days with mud. There was no threshold Cu body burden that caused death. The mean Cu concentration per gram of N. arenaceodentata (less than or equal to 24 h after death) without sediment was 270 microgram, in sand 994 microgram, in the mixture 1047 microgram, and in mud 1464 microgram. The differences in the toxic responses are discussed. (Deal-EIS)
W79-08083

TRANSFER OF MERCURY FROM FISH CARCASS TO FORMICA AQUILONIA (HYMENOPTERA, FORMICIDAE),
Helsinki Univ. (Finland). Dept. of Environmental Conservation.
For primary bibliographic entry see Field 5A.
W79-08084

THE APPLICATION OF PLASTIC ENCLOSURES TO THE STUDY OF PELAGIC MARINE BIOTA,
Skidaway Inst. of Oceanography, Savannah, GA.
For primary bibliographic entry see Field 5A.
W79-08085

ETHYL-P-AMINOBENZOATE (BENZOCAINE): EFFICACY AS AN ANESTHETIC FOR FIVE SPECIES OF FRESHWATER FISH,
National Fishery Research Lab., LaCrosse, WI.
V. K. Dawson, and P. A. Gilderhus.
Investigations in Fish Control, Report No. 87, 1979. 5 p, 5 tab, 22 ref.

Descriptors: *Fish physiology, *Toxicity, *Benzocaine, *Anesthetics, Ethyl-p-aminobenzoate, Rainbow trout, Brown trout, Carp, Pikes, Bass, Freshwater fish, Sockeye salmon, Chinook salmon, Lake trout, Hardness(Water), Fish behavior, Fish management, Fish eggs, Mortality, Water temperature, Hydrogen ion concentration.

Ethyl-p-aminobenzoate (benzocaine) was tested for its efficacy as an anesthetic for rainbow trout, brown trout, northern pike, carp, and largemouth bass. Concentrations of 100 to 200 mg/1 were required for large adult northern pike, compared with 50 to 100 mg/1 for small fish. Rates of sedation and recovery were slower in cold water than in warm water. Water hardness had little influence on the activity of benzocaine. Fish were anesthetized faster and recovered more slowly in acid than in alkaline water. Benzocaine produced deep anesthesia, but concentrations that rendered the fish handleable within 5 min were generally not safe for exposures longer than 15 min. Concentrations of benzocaine efficacious for fish were not acutely toxic to eggs of coho salmon, chinook salmon, rainbow trout, brown trout, or lake trout. Benzocaine is not registered for fishery use and is neither more effective nor safer than the registered anesthetic, tricaine methanesulfonate (MS-222). (Deal-EIS)
W79-08086

INFLUENCES OF SELECTED ENVIRONMENTAL FACTORS ON THE ACTIVITY OF A PROSPECTIVE FISH TOXICANT, 2-(DIGERANYLAMINO)-ETHANOL, IN LABORATORY TESTS,
National Fishery Research Lab., LaCrosse, WI.
For primary bibliographic entry see Field 5A.
W79-08087

TOXICITIES OF THE LAMPRICIDES 3-TRIFLUOROMETHYL-4-NITROPHENOL (TFM) AND THE 2-AMINOETHANOL SALT OF 2',5-DICHLORO-4'-NITROSALICYLANILIDE (BAYER 73) TO FOUR BIRD SPECIES,
Fish and Wildlife Service, Laurel, MD. Patuxent Wildlife Research Center.
R. H. Hudson.
Investigations in Fish Control, Report No. 89, 1979. 5 p, 2 tab, 14 ref.

Descriptors: *Organic pesticides, *Pesticide toxicity, *Birds, *Lampricides, *TFM, *Bayer 73, *Bobwhites, *Quail, Animal physiology, Mortality, Lethal limit, Lampreys, Mallard Duck, Gulls, Bioassay.

The acute oral toxicities of the lampricides 3-trifluoromethyl-4-nitrophenol (TFM) and the 2-aminoethanol salt of 2',5-dichloro-4'-nitrosalicylanilide (Bayer 73, Bayluscide) were determined in mallards (Anas platyrhynchos), ring-billed gulls (Larus delawarensis), bobwhites (Colinus virginianus), and California quail (Lophortyx californicus). Ring-billed gulls were the most sensitive to both chemicals, alone and in combination. Field grade TFM (35% TFM in N,N-dimethylformamide) was toxic; median lethal dosages (LD50's) ranged from 250 mg/kg in gulls to 546 mg/kg in California quail. Toxicity of Bayer 73(70%) was lower; LD50 values ranged from 500 mg/kg in gulls to more than 2,000 mg/kg in mallards and bobwhites. Field grade TFM was more toxic than purified TFM(>96% pure) to mallards. Toxicity of a mixture of Bayer 73 with field grade TFM was additive in gulls and possibly additive in mallards. Mallards exposed for 48 h to drinking and swimming water containing the lampricides showed mild signs of intoxication but no birds became severly ill. On the basis of these studies, use of TFM or Bayer 73, alone or in combination, presents little toxic hazard to birds when applied in the amounts routinely used for lamprey control. (Deal-EIS)
W79-08088

THE IMPACT OF OIL POLLUTION ON INTERTIDAL MEIOFAUNA. FIELD STUDIES AFTER THE LA CORUNA-SPILL, MAY 1976,
Hamburg Univ. (Germany, F.R.). Museum of Zoology.
For primary bibliographic entry see Field 5A.
W79-08089

OVERWINTER MORTALITY OF FINGERLING SMALLMOUTH BASS IN RELATION TO SIZE, RELATIVE ENERGY STORES, AND ENVIRONMENTAL TEMPERATURE,
Toronto Univ. (Ontario). Dept. of Zoology.
J. D. Oliver, G. F. Holeton, and K. E. Chua.
Transactions of the American Fisheries Society, Vol. 108, p 130-136, 1979. 4 fig, 2 tab, 18 ref.

Descriptors: *Bass, *Mortality, *Water temperature, Bass, Seasonal, Winter, Size, Weight, Length, Fry, Cold resistance, Fish physiology, Small mouth bass, Aquiculture.

Hatchery-reared, 0+ age smallmouth bass (Micropterus dolomieui) of 55-107 mm total length were 'wintered' from September 1975 to May 1976. Temperature regimes were modelled on those of the natural environment and final temperatures were 2, 4, and 6 C. Final wintering temperature did not noticeably influence mortality rates. Long fish survived the period of low temperature better than did shorter ones. Body ratios of dry weight/wet weight, lipid weight/dry weight, and ignitable weight/dry weight all decreased during wintering, and the data indicated that there may be critical percentages of dry weight/wet weight and ignitable weight/dry weight below which these fish will die. (Deal-EIS)
W79-08090

COPPER LETHALITY TO RAINBOW TROUT IN WATERS OF VARIOUS HARDNESS AND PH,
Guelph Univ. (Ontario). Dept. of Zoology.
R. S. Howarth, and J. B. Sprague.
Water Research, Vol. 12, No. 7, p 455-462, 1978. 3 fig, 2 tab, 43 ref.

Descriptors: *Environmental effects, *Toxicity, Copper, Hydrogen ion concentration, Hardness(Water), Rainbow trout, Mortality.

Rainbow trout were tested at various combinations in waters of nominal total hardness 30, 100, and 360 mg/1 as CaCO3 and pH 9, 8, 7, 6, and 5. The 96 h LC50 of total dissolved copper varied from 20 microg/1 in soft acid water to 520 microg/1 in hard alkaline water. One general effect was that high hardness decreased toxicity at any pH. Increasing H-ion content had a variable effect; there was a decrease, then an increase, and subsequently a decrease in copper toxicity. Larger trout were more resistant than smaller ones and this effect of size appeared to be the same at different hardness and pH combinations. Ionic copper and two ionized copper hydroxides appeared to be the toxic species of copper. (Chilton-ORNL)
W79-08124

SOME FEATURES OF FEEDING, RESPIRATION AND ENERGY CONVERSION OF DAPHNIA MAGNA,
Rijksinstituut voor Natuurbeheer, Leersum (Netherlands). Kasteel Broekhuizen.
K. Kersting.
Hydrobiologia, Vol. 59, No. 2, p 113-120, 1978. 10 fig, 10 ref.

Descriptors: *Environmental effects, *Temperature, *Food abundance, Growth rate, Energy budget, Daphnia.

Energy conversion in Daphnia magna in relation to food concentration and temperature was investigated. Up to a critical food concentration, uptake of food was proportional to the concentration and above this concentration food uptake was constant. Growth efficiency was found to be independent of food concentration. The effect of temperature was different for high and low food concentrations. Maximal growth efficiency was observed at 10 C. Growth efficiency was negative at temperatures above 22 C. (Chilton-ORNL)
W79-08125

OPTIMUM TEMPERATURE FOR FEEDING AND GROWTH OF TILAPIA ZILLII,
California Univ., Riverside. Div. of Biological Control.
S. Platt, and W. J. Hauser.
The Progressive Fish-Culturist, Vol. 40, No. 3, p 105-107, July 1978, 1 fig, 1 tab, 6 ref.

Descriptors: *Environmental effects, *Temperature, Fish, Growth rate, Feeding rates, Weed control.

Water temperatures in which Tilapia zillii were grown was increased about 2.6 C every two weeks from 20.8 to 34 C. The fish were fed lettuce and were weighed each time the water temperature was increased to determine their growth during that two-week period. It was found that the optimum temperature for feeding was between 28.8 and 31.4 C when the feeding rate averaged 171% of the fish's body weight of lettuce in 24 h. Fastest growth rate was at 31.4 C at which the fish averaged an increase of 3.42% of their body weight in

24 h. It was concluded that Tilapia zillii could be used as an economical method of weed control only in areas where average water temperatures do not exceed 22 C for a substantial portion of the year. (Chilton-ORNL)
W79-08126

EFFECT OF TEMPERATURE ON GROWTH AND MOLTING OF PALAEMON SERRATUS IN RELATION TO THEIR SIZE, (INFLUENCE DE LA TEMPERATURE SUR LA CROISSANCE ET LA MUE DE PALAEMON SERRATUS EN FONCTION DE LEUR TAILLE),
Centre d'Oceanographie, Marseille (France). Station Marine d' Endoume.
P. Richard.
Aquaculture, Vol. 14, No. 1, p 13-22, May 1978, 3 fig, 1 tab, 16 ref.

Descriptors: *Environmental effects, *Temperature, *Shrimp, Growth rate, Growth stages, Size.

Temperature effects on growth, molt cycle duration, and intermolt stages of Palaemon serratus in relation to body size were investigated. Optimum growth temperature was found to be 22 C. Young shrimp were less affected by temperature differences from this optimum than old ones. Extremely low temperatures depressed growth of smallest shrimp while high temperatures depressed growth of old animals. Molt cycle duration was found to be directly and linearly related to shrimp length. Increasing temperature shortened the molt cycle duration according to a hyperbolic curve and had a greater effect on largest animals. Relative durations of molt stages were not significantly affected by body size or temperature. (Chilton-ORNL)
W79-08127

TOLERANCE AUX TEMPERATURES EXTREMES DE PALAEMON SERRATUS (PENNANT): INFLUENCE DE LA TAILLE ET DE L'ACCLIMATION,
Centre d'Oceanographie, Marseille (France). Station Marine d'Endoume.
P. Richard.
Journal of Experimental Marine Biology and Ecology, Vol. 35, No. 2, p 137-146, November 1978, 2 fig, 1 tab, 24 ref.

Descriptors: *Environmental effects, *Temperature, Shrimp, Mortality, Size, Acclimation.

Shrimp ranging in size from 2-6 cm were acclimated to temperatures of 13, 17, 21, and 25 C and then tested for tolerance to extremes of high and low temperature. An increase in tolerance to low temperature and a decrease in tolerance to high temperature was seen with increasing body size. Upper and lower lethal temperatures of different size groups for each acclimation temperature were similar, however. It was observed that at acclimation temperatures close to tolerance limits, no advantage was gained by acclimation. Acclimation, generally had a more pronounced effect on tolerance to extreme temperatures than did body size. (Chilton-ORNL)
W79-08128

COLD TOLERANCE AT THREE SALINITIES IN POST-LARVAL PRAWNS, MACROBRACHIUM ROSENBERGII (DE MAN),
South Carolina Medical Univ. of Charleston. Dept. of Physiology.
S. U. Silverthorn, and A. M. Reese.
Aquaculture, Vol. 15, No. 3, p 249-255, 1978, 1 fig, 2 tab, 16 ref.

Descriptors: *Environmental effects, *Temperature, Salinity, Cold resistance, Invertebrates, Prawns, Acclimation.

Post-larval prawns were acclimated to 27, 22, or 16 C at salinities of 5. 8, or 14% salinity to determine whether animals reared in the laboratory at 27 C would benefit from pre-acclimation to lower temperature prior to being stocked in ponds in spring. Survival was significantly better in prawns acclimated to 22 C or below while salinity did not appear to have a significant effect on survival. Increased survival with decreased acclimation temperature was most obvious in prawns subjected to 13 C. Exposure to cold did not adversely affect later growth. (Chilton-ORNL)
W79-08130

BIOENERGETIC AND DEVELOPMENTAL RESPONSE OF A MAYFLY TO THERMAL VARIATION,
Pennsylvania Univ., Philadelphia; and Academy of Natural Sciences of Philadelphia, PA. Stroud Water Research Center.
B. W. Sweeney.
Limnology and Oceanography, Vol. 23, No. 3, p 461-477, 1978, 7 fig, 7 tab, 53 ref.

Descriptors: *Environmental effects, *Temperature, *Mayflies, Growth stages, Growth rates, Energy budget.

The effects of diel and seasonal changes in natural and experimental temperature regimes on egg development, nymphal growth and respiration, and adult fecundity of the mayfly is reported. Egg developmental time and degree-hour accumulations for eclosion were related inversely to maximum diel temperature in regimes pulsing above 14 C. Small difference between minimum and average temperatures among experimental regimes suggested that diel maximum may be the best predictor for rate of egg development at fluctuating temperatures. Subimago body size and fecundity for winter generation females were approximately double those for the summer generation. Weight-specific respiration rates of nyphs (measured at 14 constant temperatures over the range of 1 - 21 C) were found to increase with temperature but were inversely related to body size at a given temperature. Temperature-specific stimulation of metabolic processes was observed. Calculation of energy budgets for male and female nymphs reared in various thermal regimes showed that growth rates, net growth efficiencies, and production: respiration ratios of females were about double those of males. (Chilton-ORNL)
W79-08131

EFFECT OF FISH SIZE, TEMPERATURE, AND AMOUNT FED ON NUTRIENT DIGESTIBILITY OF A PELLETED DIET BY RAINBOW TROUT, SALMO GAIRDNERI,
Colorado Univ., Boulder. Dept. of Environmental, Population and Organismic Biology.
J. T. Windell, J. W. Foltz, and J. A. Sarokon.
Transactions of the American Fisheries Society, Vol. 107, No. 4, p 613-616, 1978. 3 tab, 23 ref.

Descriptors: *Environmental effects, *Temperature, *Size, *Food abunance, Rainbow trout, Nutrients, Metabolism, Digestibility coefficients.

Three sizes of rainbow trout (18, 207, 586 g) were acclimated at three water temperatures (7, 11, and 15 C) and fed three meal sizes (0.4, 0.8, and 1.6% of fish weight). Digestibility coefficients for all nutrients were significantly lower for 18 g trout acclimated to 7 C than in other cases. The grand average coefficients for protein, lipid, and energy (excluding small fish at 7 C) were 93%, 89%, and 74%, respectively. These values for 18 g trout acclimated at 7 C were 20%, 9%, and 28% lower, respectively. Ration size did not significantly influence digestibility. It was concluded that the data presented resolve the question about effect of water temperature, body size and amount fed on nutrient digestibility by rainbow trout. (Chilton-ORNL)
W79-08132

WATER TEMPERATURE FLUCTUATIONS AND SEASONAL PERIODICITY OF CLADOPHORA AND POTAMOGETON IN SHALLOW RIVERS,
Ontario Ministry of the Environment, Rexdale. Limnology and Toxicity Section.
S. L. Wong, B. Kirby, R. F. Kosciuw, and B. Clark.
Journal of the Fisheries Research Board of Canada, Vol. 35, No. 6, p 866-870, 1978. 5 fig, 11 ref.

Descriptors: *Environmental effects, *Temperature, *Nuisance algae, Cladophora, Aquatic weeds, Seasonal, Rivers, Pondweeds.

This paper reports investigations into the influence of water temperature on nuisance plant species under field conditions where nutrients were not limiting. In the river systems studied, a community dominated by Cladophora glomerata in late spring was usually replaced by a Potamogeton pectinatus dominated community. It was found that the tolerance limits of these two species at a given value of mean or maximum temperature vary with daily range. Temperatures of 18-22 C with daily fluctuation of <4 C supported a mixed plant community. It was concluded that temperature regulation could provide a sound basis for controlling nuisance vegetation. (Chilton-ORNL)
W79-08133

PRODUCTION OF WHITE CRAPPIE IN LAKE NASWORTHY, TEXAS
Texas A and M Univ., College Station. Dept. of Wildlife and Fisheries Sciences.
C. F. Yeh.
The Southwestern Naturalist, Vol. 23, No. 1, p 111-116, February 1978, 2 tab, 13 ref.

Descriptors: *Environmental effects, *Seasonal, Temperature, Growth rate, Biomass, Population, Sunfishes.

Production of white crappie (Pomoxis annularis Rafinesque) in a large reservoir (surface area of 646 ha and average depth of 2.7 m) was determined. Estimated biomass varied seasonally from 16.9 to 59.2 kg/ha. White crappie spawn in Lake Nasworthy during April and March. A smaller increase was seen in population than in biomass from April to September indicating that the increase in growth rate and decrease in mortality of older fish largely compensated for slower increase in numbers. Based on comparison with other species that predominate in temperate regions, white crappie production in this lake is in the lower end of the range of reported values. (Chilton-ORNL)
W79-08134

A COMPARISON OF PUMP SAMPLING SYSTEMS FOR LIVE ZOOPLANKTON COLLECTION,
Michigan Univ., Ann Arbor. Great Lakes Research Div.
W. L. Yocum, M. S. Evans, and B. E. Hawkins.
Hydrobiologia, Vol. 60, No. 3, p 199-202, 1978, 2 fig, 6 ref.

Descriptors: *Environmental effects, *Zooplankton, Powerplants, Cooling water, Sampling, Equipment, Mortality.

Two different methods for filtering plankton from continuously pumped samples from the cooling water intake of a nuclear power plant are described. Observations showed that an in-line filter trap located on the suction side of the pump provided the lowest sampling mortality. (Chilton-ORNL)
W79-08135

THE INFLUENCE OF DAY LENGTH, TEMPERATURE AND SEASON ON THE HATCHING RHYTHM OF HOMARUS GAMMARUS,
Liverpool Univ., Port Erin (England). Dept. of Marine Biology.
J. R. Branford.
Journal of the Marine Biological Association of the United Kingdom, Vol. 58, No. 3, p 639-658, 15 fig, 2 tab, 13 ref.

Descriptors: *Environmental effects, *Spawning, *Lobsters, Temperature, Seasonal, Photoperiodism.

This study establishes that the endogenous component of the hatching rhythm of lobsters is in the female. Released larvae is confined to a few minutes at night and is repeated at a similar time on each night over several weeks. The time when females release larvae in light/dark regimes is

shown to be dependent upon temperature, day-length and previous photoperiodic experience. It was found that berried lobsters releasing larvae show a free-running rhythm in continuous darkness. This rhythm maintained a period close to 24 h, independent of temperature, during the summer. Period lengths recorded during the winter were found to be influenced by temperature and generally to be longer than 24 h. (Chilton-ORNL)
W79-08136

EFFECTS OF COPPER ON THE SABELLID POLYCHAETE, EUSDISTYLIA VANCOUVERI: I. CONCENTRATION LIMITS FOR COPPER ACCUMULATION,
Battelle Pacific Northwest Labs., Sequim, WA. Marine Research Lab.
J. S. Young, R. L. Buschbom, J. M. Gurtisen, and S. P. Joyce.
Archives of Environmental Contamination and Toxicology, Vol. 8, No. 1, p 97-106, 1979. 3 fig, 4 tab, 24 ref.

Descriptors: *Environmental effects, Absorption, Copper, Invertebrates, Aquatic life, Worms, Eudistylia vancouveri, Accumulation.

In an effort to determine the level of total copper in seawater needed to sustain an increasing net tissue uptake with time, Eudistylia vancouveri were exposed to total copper concentrations of 1, 3, and 6 microg/l seawater. Analysis of internal organs showed that copper is accumulated rather than simply adsorbed to the body surface. The branchial crown concentrated more copper than the body. Accumulation was influenced by size but not sex. It was concluded that under certain conditions Eudistylia vancouveri will accumulate increasing amounts of copper with time at a concentration between 3 and 6 microg/l total copper. (Chilton-ORNL)
W79-08137

CONCENTRATIONS OF CD, CU, MN, PB, AND ZN IN FISHES IN A HIGHLY ORGANIC SOFTWATER POND,
Savannah River Ecology Lab., Aiken, SC.
J. G. Wiener, and J. P. Giesy, Jr.
Journal of the Fisheries Research Board of Canada, Vol. 36, No. 3, p 270-279, 1979. 1 fig, 7 tab, 52 ref.

Descriptors: *Environmental effects, *Trace elements, Fish, *Absorption, Water quality, Hardness(Water), Cadmium, Copper, Manganese, Lead, Zinc, Acidic water, Monitoring.

The primary objective of this study was to compare availability to fish of selected trace metals in an acidic, highly organic pond with availability in hardwater systems. Analyses of the metals were conducted on eight species of resident fishes from the pond and on stocked bluegill. Data indicated a homeostatic regulation of Cu, Mn, and Zn in resident and stocked fish. Mean axial muscle and whole body concentrations of Cu, Mn, and Zn in stocked bluegill were relatively constant approximately 200 d after stocking and did not change substantially with growth. Data indicated that Pb in this system was less available to fish than in hardwater lakes while Cd was equally as available to fish as in harder waters. It was concluded that these results have important implications for biological monitoring programs and that use of fish for such monitoring should be limited to nonessential metals that accumulate in the body with exposure. (Chilton-ORNL)
W79-08140

METABOLIC ADAPTATION OF CANCER IRRORATUS DEVELOPMENTAL STAGES TO CYCLIC TEMPERATURES,
Rhode Island Univ., Kingston. Graduate School of Oceanography.
A. N. Sastry.
Marine Biology, Vol. 51, No. 3, p 243-250, 1979. 5 fig, 2 tab, 39 ref.

Descriptors: *Environmental effects, *Temperature, *Metabolism, Cycles, Crabs.

These investigations showed generally that the metabolic rate of the developmental stages of Cancer irroratus cultured at 10 to 20 C daily cyclic and 15 C constant temperatures is modified with temperature, with higher Q10 (temperature coefficients) values (>2) at the lower temperatures, compensation with Q10's between 1 and 2 in the mid-range, and depression with Q10 values less than 1 at the higher temperatures. Compensatory response range for larvae cultured at a constant temperature of 15 C narrowed with development from first zoeae to later zoeal stages. For individuals cultured in the 10 to 20 C cyclic regime, compensatory response of first zoeae, megalops, and crab stages within the range 10 to 25 C was interrupted by a zone of thermal sensitivity between 15 and 20 C. Metabolic-temperature response of each developmental stage varied relative to the thermal culture regime as evidenced by increased respiration and metabolic rate compensation between 20 and 25 C, and by an extension of the metabolically active range towards higher temperature. (Chilton-ORNL)
W79-08143

TISSUE UPTAKE OF CADMIUM IN BROOK TROUT DURING CHRONIC SUBLETHAL EXPOSURE,
Fisheries and Marine Service, Halifax (Nova Scotia). Dept. of Environment.
G. B. Sangalang, and H. C. Freeman.
Archives of Environmental Contamination and Toxicology, Vol. 8, No. 1, p 77-84, 1979. 1 fig, 3 tab, 15 ref.

Descriptors: *Environmental effects, *Cadmium, Brook trout, Absorption.

Brook trout exposed to one ppb Cd in water accumulated Cd in gills, kidneys and liver in concentrations proportional to time of exposure. Greatest accumulation was in the gills and posterior kidneys with mean Cd concentrations showing a positive linear correlation (r= 0.99 and 0.94, respectively) with time. Accumulation of Cd in the gills appeared to be dose-dependent as well as time-dependent. Fish receiving injections of one microg/g of body weight, once a week for 16 weeks showed a definite positive accumulation in gills and posterior kidneys but with less accumulation in gills compared to fish exposed to Cd in water. (Chilton-ORNL)
W79-08147

EFFECTS OF MANGANESE, COPPER AND LEAD ON SELENASTRUM CAPRICORNUTUM AND CHLORELLA STIGMATOPHORA,
California Univ., Irvine. School of Engineering.
E. R. Christensen, and J. Scherfig.
Water Research, Vol. 13, No. 1, p 79-92, 1979. 8 fig, 10 tab, 21 ref.

Descriptors: *Environmental effects, *Metals, Toxicity, Algae, Manganese, Copper, Lead, Synergism, Antagonism.

In this study algal assays showed that a 50% reduction in the total algal cell volume of Selenastrum capricornutum in SAAM occurs in the presence of either 3.1 mg manganese/l, 85 microg copper/l, or 140 microg lead/l, added singly. 50% reduction in the total algal cell volume of Chlorella stigmatophora in 28 ppt ASW plus full SAAM nutrients occurs in the presence of either 50 mg manganese/l, 70 microg copper/l, or 700 microg lead, added singly. Data showed evidence for synergism between manganese and copper, antagonism between manganese and lead, and antagonism between copper and lead. A product model is considered to be a more reasonable reference for no-interaction than an additive model for experiments in which toxic metals are added in combination. (Chilton-ORNL)
W79-08148

TEMPERATURE AND OXYGEN-NITROGEN GAS RATIOS AFFECT FISH SURVIVAL IN AIR-SUPERSATURATED WATER,
Corvallis Environmental Research Lab., OR.
A. V. Nebeker, A. K. Hauck, and F. D. Baker.
Water Research, Vol. 13, No. 3, p 299-303, 1979. 2 fig, 2 tab, 14 ref.

Descriptors: *Environmental effects, *Temperature, *Gases, Oxygen, Nitrogen, Fish, Salmonids, Supersaturation, Mortality.

Steelhead trout smolts and juvenile chinook, coho, and sockeye salmon were tested at 8, 9, 10, 12, 15, 18, and 20 C at total gas supersaturation concentrations of 115, 116, 117, 118, and 120%. The effect of different temperatures and constant supersaturation concentration on survival of the fish varied with species. Increased temperatures caused a very significant increase in steelhead mortality, a significant increase in chinook deaths, but no significant effect on coho or sockeye mortality. Using regression models, highly significant ($P<0.001$) and significant ($P<0.005$) temperature effects were shown on steelhead and chinook, respectively. For sockeye and coho, such regressions did not show a significant effect of temperature for either the LT50 or LT20. Mixed gas tests with steelhead showed that there was a significant difference ($P<0.05$) in time to death at different O2/N2 ratios when fish were tested at the same total dissolved gas pressure. (Chilton-ORNL)
W79-08149

THE EFFECT OF INTERMITTENT CHLORINATION OF FRESHWATER PHYTOPLANKTON,
Wisconsin Univ.-Milwaukee. Dept. of Zoology.
A. S. Brooks, and N. E. Liptak.
Water Research, Vol. 13, No. 1, p 49-52, 1979. 2 fig, 15 ref.

Descriptors: *Environmental effects, *Water pollution, Chlorination, Phytoplankton, Photosynthesis.

Chlorination of Lake Michigan water for periods of 30 minutes resulted in phytoplankton showing a reduction of chlorophyll a and an increase in phaeophytin a concentrations. These effects were most pronounced at chlorine concentrations greater than 1.0 mg/l while concentrations less than about 0.1 mg/l produced only slight changes. Following an initial decrease, carbon uptake rates showed almost complete recovery after 24 h at chlorine concentrations of less than 0.1 mg/l. (Chilton-ORNL)
W79-08150

EFFECTS OF FLUCTUATING TEMPERATURE ON DURATION OF EGG DEVELOPMENT OF CHYDORUS SPHAERICUS (CLADOCERA, CRUSTACEA),
Michigan Technological Univ., Houghton. Dept. of Biological Sciences.
R. Keen.
Journal of Thermal Biology, Vol. 4, p 5-8, 1979. 2 fig, 4 tab, 11 ref.

Descriptors: *Environmental effects, *Temperature, Embryonic growth stage, Time, Zooplankton, Crustaceans, Fluctuating temperatures.

The purpose of this investigation was to determine if duration of egg development of Chydorus sphaericus was similar at constant 20 C and at fluctuating 20 C and to test for differences in duration of egg development of animals collected a few days apart from the same location. It was found that duration of egg development differed significantly under four temperature cycles, all of which averaged 20 C. Duration of development was also significantly different among groups of animals collected several days apart. Differences in duration of egg development under the four temperature cycles was explained by the Kaufmann effect. It was concluded that the prediction of development times in fluctuating temperatures is more accurate if the weighted average rate of development is used rather than the rate of development at the weighted averaged temperature. (Chilton-ORNL)
W79-08152

COLORADO RIVER DESALINATION WILD DUCK STUDY,

Colorado State Univ., Fort Collins. Dept. of Physiology and Biophysics.
D. H. Will, J. H. Abel, B. E. Russell, and K. E. Levine.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-275 681, Price codes: A03 in paper copy, A01 in microfiche. Final Project Report, June 28, 1977. 25 p, 7 tab, 6 ref, 1 append.

Descriptors: *Saline water, *Salt tolerance, *Waterfowl, *Dehydration, *Mallard duck, Water pollution effects, Water quality, Water properties, Water temperature, Mortality, Animal behavior, Animal physiology, Paradox Valley(Colorado).

An investigation was conducted to determine the possible detrimental effects of concentrated salt water simulating approximately 70% evaporation of the Paradox Valley, Colorado, drainage on the wild mallard duck. In seven separate experiments 47 females and 47 males were exposed to a supersaturated salt or brine water pool under varying ambient air and water temperatures to determine its effect on behavior, viability, and several physiologic parameters. It was demonstrated that highly concentrated salt or brine water can be lethal to wild waterfowl. Mortality in the ducks exposed to the salt water seemed to be related to dehydration and hypothermia. When the ducks were placed in highly concentrated salt water they soon showed discomfort, and preferred to leave the saline pool when given a choice. This suggests that ducks in the wild landing on a brine pool would most likely choose to leave for a fresh water source or surrounding land. The results indicated that free access to fresh drinking water would possibly protect ducks and other waterfowl against the dehydration produced by exposure to concentrated salt water, and that supplying food during this period might be a protective measure against hypothermia. (Davison-IPA)
W79-08155

ENVIRONMENTAL REQUIREMENTS AND POLLUTION TOLERANCE OF TRICHOPTERA,
Purdue Univ., Lafayette, IN. Dept. of Entomology.
For primary bibliographic entry see Field 6G.
W79-08156

EVALUATION OF TOXIC EFFECTS OF ORGANIC CONTAMINANTS IN RECYCLED WATER,
Gulf South Research Inst., New Orleans, LA.
N. Gruener.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-291 379, Price codes: A06 in paper copy, A01 in microfiche. Final Report No. EPA-600/1-78-068, December 1978. 110 p, 10 fig, 70 tab, 39 ref. 68-03-2464.

Descriptors: *Toxicity, *Wastes, *Municipal wastes, Potable water, *Tertiary treatment, *Activated carbon, Human pathology, Animal pathology, Water chemistry, Chemical reactions.

In a comprehensive series of toxicological studies evaluating the health effects of recycling water for drinking, some 400,000 liters of finished water from the Blue Plains, Washington, DC. treatment plant was concentrated down to 200 liters containing 700 mg/liter of total organic carbon (TOC). The concentrate was incorporated into a gel-type diet and fed to 900 mice in different studies extended up to 150 days. Observations of the growth rate, food intake, fertility, mutagenicity and mortality, blood physiology and biochemistry, liver function test behavior, and histopathology, showed very few differences between the experimental and control groups. No change could be related to clear pathological syndrome. A second series of experiments involved testing rodent and human cells in vitro for general toxicity, mutagenicity, and carcinogenicity. All three effects in the tissue cultures were positive, and were significantly increased by the presence of a liver activation system. It is concluded that although exposure to the concentrated recycled water for 20% of a lifespan does not lead to physiological changes in mice, the positive results from the mutagenicity and carcinogenicity studies indicate a need for further studies in this area. (Davison-IPA)
W79-08159

ENVIRONMENTAL REQUIREMENTS AND POLLUTION TOLERANCE OF PLECOPTERA,
Utah Univ., Salt Lake City. Dept. of Biology.
R. F. Surdick, and A. R. Gaufin.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-289 862, Price codes: A19 in paper copy, A01 in microfiche. Report No. EPA-600/4-78-062, October 1978. 423 p, 175 ref. R803537.

Descriptors: *Aquatic insects, *Aquatic biology, *Water quality, *Stoneflies, Environmental effects, Aquatic habitats, Insect behavior, Entomology, Ecology, Freshwater, Life cycles, Benthos.

Profile forms on 363 North American species of the freshwater insects of the order Plecoptera were compiled from a survey of the major literature sources in an investigation of the environmental requirements associated with these insects. The ranges of environmental conditions under which the species have been found are indicated, and the following ecological parameters are considered: pH, nutrients, organic pollution dissolved oxygen concentration, temperature, turbidity, current and general specific habitats, seasonal emergence of adults, feeding behavior, and geographical distribution. The objectives of this project are to provide a source book of information for use by water quality investigators and to establish a baseline to encourage further ecological and systematic research. (Davison-IPA)
W79-08160

ACUTE AND CHRONIC TOXICITY OF HCN TO FISH AND INVERTEBRATES,
Minnesota Univ., St. Paul. Dept. of Entomology, Fisheries, and Wildlife.
L. L. Smith, Jr., S. J. Broderius, D. M. Oseid, G. L. Kimball, and W. M. Koenst.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-293 047, Price codes: A07 in paper copy, A01 in microfiche. Report No. EPA-600/3-79-009, January 1979. 129 p, 8 fig, 55 tab, 48 ref. R802914.

Descriptors: *Toxicity, *Cyanide, *Life cycles, *Fish, *Invertebrates, *Fish eggs, Fry, Growth stages, Spawning, Juvenile fish, Freshwater fish, Minnows, Lethal limit, Water pollution effects.

Acute and chronic toxicity of hydrogen cyanide (HCN) were determined for different life stages of seven species of fish and two invertebrates in dynamic flow-through bioassays. It was found that eggs were the most tolerant stage; fry and juvenile were the least tolerant. Temperature and dissolved oxygen concentration (DO) also affect acute toxicity. Juvenile fish became more sensitive to decreasing temperature and DO while invertebrates were less sensitive to HCN with decreasing temperature. One species of invertebrate exhibited nearly the same sensitivity to HCN as the juvenile fish, but the other was more tolerant. Long-term tests with fathead minnows demonstrated that concentrations of HCN between 12.9 and 19.6 micrograms/l had no adverse effect on egg production. In chronic tests with brook trout, demonstrated on the basis of spawning success, the maximum acceptable toxicant concentration was between 5.7 and 11.2 micrograms/l of HCN. Invertebrate chronic tests showed that the highest concentration of HCN having no adverse effect was between 29 and 40 micrograms/l for Asellus, and between 16 and 21 micrograms/l for Gammarus. Existing models of multiple toxicity were used to evaluate the lethal and sublethal effects of binary toxicant mixtures on fish. Employing the toxic unit approach, it was determined that Zn-HCN and ammonia-HCN mixtures were more acutely toxic, and the Cr-HCN mixture was less toxic than what would be predicted from simply additive interaction. (Davison-IPA)
W79-08161

DETERMINATION OF HEAVY METALS AND SELENIUM IN FISH FROM UPPER AUSTRIAN WATERS -- PART 2: LEAD, CADMIUM, SCANDIUM, CHROMIUM, COBALT, IRON, ZINC AND SELENIUM (IN GERMAN),
Oesterreichische Studiengesellschaft fuer Atomenergie G.m.b.H., Seibersdorf. Inst. fuer Biologie.
For primary bibliographic entry see Field 5A.
W79-08276

EFFECTS OF ORAL ADMINISTRATION OF CADMIUM ON FISH - IV EFFECTS ON ULTRASTRUCTURES OF HEPATIC AND RENAL CELLS OF THE CARP AND THE PORGY,
Kyushu Univ., Fukuoka (Japan). Dept. of Fisheries.
For primary bibliographic entry see Field 5A.
W79-08277

MORTALITY OF EXPERIMENTALLY DESCALED SMOLTS OF COHO SALMON (ONCORHYNCHUS KISUTCH) IN FRESH AND SALT WATER,
Fish and Wildlife Service Seattle, WA.
G. R. Bouck, and S. D. Smith.
Transactions of the American Fisheries Society, Vol. 108, p 67-89, 1979. 3 fig, 4 ref.

Descriptors: *Salmon, Coho salmon, *Freshwater, *Seawater, Salinity, Fish physiology, Animal pathology, Bioassay, Mortality, Fish migration, Estuaries, Loss of scales, Fish hatching.

Removal of slime from 25% of the body caused no deaths among smolts of coho salmon in fresh water or in seawater (28%). Removal of slime and scales from the same percentage of body area caused no deaths in fresh water, but 75% mortality within 10 days in seawater. The 10-day median tolerance limit was 10% scale removal immediately before the smolts entered seawater. Mortality was highest when the scales were removed from the area of the rib cage. Recovery of smolts in fresh water from a loss of scales that would be lethal in seawater occurred rapidly; 90% of the fish regained tolerance to seawater within 1 day. (Katz-EIS)
W79-08279

MODEL OF RAPID DETECTION OF SUBLETHAL EFFECTS OF POLLUTANTS: MODIFICATION OF AMYLASE AND TRYPSIN LEVELS OF ARTEMIA SALINA CONTAMINATED BY COPPER OR ZINC, (IN FRENCH),
Centre National pour l'Exploitation des Oceans, Paris (France); and Centre Oceanologique de Bretagne, Brest (France).
For primary bibliographic entry see Field 5A.
W79-08280

THE ISOLATION RESPONSE OF MUSSELS (MYTILUS EDULIS L.) EXPOSED TO FALLING SEA-WATER CONCENTRATIONS,
University Coll. of North Wales, Menai Bridge. Marine Science Labs.
J. Davenport.
Journal of the Marine Biological Association of the United Kingdom, Vol. 59, p 123-132, 1979. 3 fig, 2 tab, 5 ref.

Descriptors: *Mussels, *Salinity, Molluscs, Seawater, Animal behavior, Animal physiology, Environmental effects, Mytilus, Benthos, Marine benthos, Wastes, Laboratory tests, Freshwater, *Estuaries.

The salinity of the water retained within the mantle cavity of mussels after the shell valves have closed in response to falling environmental salinities is influenced by the rate of external salinity change. At high rates of salinity change the retained water salinity is significantly higher than in animals exposed to slowly changing salinities. However, the mantle fluid salinity is not primarily determined by the timing of shell valve adduction, but by closure of the exhalant siphon. Once this siphon has closed mantle cavity irrigation ceases and a mussel can remain in a gaping, partially isolated state, for periods dependent upon the rate of external salinity change, without suffering sig-

nificant dilution of the mantle fluid. Eventually the inhalant siphon and shell valves close, but during the period of partial isolation the oxygen tension of the mantle fluid falls more slowly than in circumstances when the sequence of siphon and valve closure is rapid. It is suggested that this behaviour may give mussels a significantly increased period of oxygen availability at estuarine distribution sites. (Karz-EIS)
W79-08281

ECOLOGOBIOCHEMICAL CHARACTERISTICS OF HYDROCARBONS IN SOME MEDITERRANEAN SEA ORGANISMS,
Institute of Biology of Southern Seas, Sevastopol, (USSR).
For primary bibliographic entry see Field 5A.
W79-08282

EFFECT OF WATER SOLUBLE FRACTION OF PRUDHOE BAY CRUDE OIL ON EMBRYONIC DEVELOPMENT OF PACIFIC HERRING,
Alaska Univ., Fairbanks.
R. L. Smith, and J. A. Cameron.
Transactions of the American Fisheries Society, Vol. 108, p 70-75, 1979. 2 tab, 18 ref.

Descriptors: *Oil, *Oil pollution, Water pollution effects, Marine fish, *Herring, Alaska, Prudhoe Bay Crude, Toxicity, Bioassay, Mortality, Fish eggs, Juvenile fish, *Water soluble hydrocarbons, Pacific herring, Animal pathology, Fish reproduction.

This project sought to simulate conditions of a crude oil spill to test the effects of low boiling point, water-soluble hydrocarbon components of Prudhoe Bay crude oil on developing Pacific herring embryos. Initial hydrocarbon concentrations in the experimental containers were less than 1 microgram/g H2O. Exposure for 48 hours led to a significantly higher incidence of gross morphological abnormalities. Exposure for 6 days resulted in 100% mortality of the fertilized embryos. Gross abnormalities usually consisted of flexures in the body which reduced or prevented locomotion. Results of scanning electron microscopy reveal other defects, such as improperly formed mouths, which adversely affect biological fitness yet are difficult to detect. Exposure for 12 hours or longer led to reduced size of newly hatched larvae, suggesting hydrocarbon exposure adversely affects embryonic metabolism. (Katz-EIS)
W79-08283

IODINE BALANCE IN RAINBOW TROUT (SALMO GAIRDNERI) AND EFFECTS OF TESTOSTERONE PROPIONATE,
Manitoba Univ., Winnipeg. Dept. of Zoology.
For primary bibliographic entry see Field 5A.
W79-08287

EFFECTS OF THE SPAWNING MIGRATION OF THE ALEWIFE, ALOSA PSEUDOHARENGUS, ON FRESHWATER ECOSYSTEMS,
Rhode Island Univ., Kingston. Graduate School of Oceanography.
For primary bibliographic entry see Field 5B.
W79-08289

MERCURY POLLUTION OF THE MARINE ENVIRONMENT IN THE REGION OF MARSEILLE, MEDITERRANEAN, FRANCE. PART 3-DEGREE OF CONTAMINATION BY MERCURY OF THE ECHINODERMS LIVING IN THE KELP BEDS IN THE VICINITY OF THE LARGE SEWER OF THE CITY OF MARSEILLES, (IN FRENCH),
Aix-Marseille-2 Univ. (France). Sciences de la Mer et de l'Environment.
For primary bibliographic entry see Field 5A.
W79-08290

THERMAL SHOCK EFFECTS ON LARVAE OF CADDIS FLY BRACHYCENTRUS AMERICANUS,
Environmental Protection Lab.-Duluth, MN.
J. A. Salmela, and R. L. Anderson.
Journal of the Minnesota Academy of Science, Vol. 44, p 25-27, 1978. 4 fig, 3 tab, 9 ref.

Descriptors: *Water temperature, *Aquatic insects, Benthos, Caddis flies, *Caddis fly larvae, Brachycentrus, Water pollution effects, Bioassay, Laboratory tests, Mortality, Methodology, Laboratory equipment, Thermal stress, Thermal pollution, Thermal water, *Thermal shock.

Caddis fly larvae were subjected to thermal shocks of 30-minute and 60-minute duration in June, September, and December of 1976. Temperatures at collection were 14.7, 10.4, and 1.2 C, respectively. The TL50's for both 30-minute and 60-minute shock durations ranged from 33.3 C to 34.0 C for each month, except for a 30-minute exposure in September, which had a TL50 of 34.6 C. Larvae from a December exposure were held for 16 days to observe postexposure behavior. Feeding was reduced 50 percent among specimens exposed to temperatures 1.2 C below the 30-minute TL50 and 3.6 C below the 60-minute TL50. (Katz-EIS)
W79-08291

GRASS CARP: EFFECTS OF SALINITY ON SURVIVAL, WEIGHT LOSS, AND MUSCLE TISSUE WATER CONTENT,
Florida Univ., Gainesville. School of Forest Resources and Conservation.
M. J. Maceina, and J. V. Shireman.
The Progressive Fish Culturist, Vol. 41, p 69-73, 1979. 2 tab, 23 ref.

Descriptors: *Salinity, Toxicity, *Mortality, Bioassay, Laboratory tests, Freshwater fish, Grass carp, *Fish physiology, Estuaries, Survival, Weight loss, Muscle tissue, *Water content, Fish management, Fresh water ecosystem.

Fingerling grass carp, 100-120 mm total length, were exposed to various hypotonic and hypertonic waters to determine tolerance, body weight loss, and muscle tissue water content. After acclimation at 8.0%, LD50's for 24, 48, and 96 h were of 15.7, 15.1 and 15.1% salinity, respectively. No mortalities occurred in fish exposed at 14.0% for 96 h; at 12.0 and 14.0%, decreases of 8.5 and 11.3% in total body weight occurred. At lower salinities, declines in body weight were only 0.8%-1.7%. As salinity increased, the water content of muscle tissue declined from 80.0% in fresh water to 74.4% at 14.0%. Death at salinities higher than 14.0% was attributed to the failure of cellular processes to adjust to dehydration. (Katz-EIS)
W79-08293

EFFECTS OF SALINITY ON HATCHING SUCCESS OF THE CUI-UI,
Fish and Wildlife Service Reno, NV. Fishery Research.
D. A. Chatto.
The Progressive Fish Culturist, Vol. 41, p 82-89, 1979. 3 tab, 13 ref.

Descriptors: *Salinity, *Saline lakes, Saline water, *Salt tolerance, Nevada, Pyramid Lake, Fresh water fish, Fish eggs, Cui-ui, Fish physiology, *Fish reproduction, Fish eggs, Fish management, Laboratory tests, Bioassays.

Fertilized eggs of cui-ui were incubated in Pyramid Lake water (salinity, 5.2%), two dilutions of the lake water (salinities of 3.8 and 1.8%), and fresh well water. Experimental laboratory results indicate that some cui-ui eggs could hatch in Pyramid Lake where salinity approximates 1.8% and that hatching success would greatly diminish where the salinity approached 3.8%. Experimental data also indicated a significant decrease in egg size and mean total length of larvae as salinity increased. (Katz-EIS)
W79-08294

MEDICATION INHIBITS TOLERANCE TO SEAWATER IN COHO SALMON SMOLTS,
Fish & Wildlife Service, Seattle, WA.
G. R. Bouck, and D. A. Johnson.
Transactions of the American Fisheries Society, Vol. 108, p 63-66, 1979. 7 ref.

Descriptors: Salmon, *Coho salmon, Fish migration, *Fish diseases, Fish management, Fish establishment, Fish hatcheries, Fish parasites, Laboratory tests, Bioassay, Juvenile fish, Sea-water, Salinity, Herbicides, *2,4-D, *Simazine, Quinaldine, MS-222, *Potassium permanganate, Malachite green, Metals, *Copper sulfate.

Applications of 10 therapeutic and two anesthetic agents to healthy smolts of coho salmon by conventional methods were followed by two different posttreatment circumstances. In condition I, fish were treated and then transferred directly to 28% seawater for 10 days; in condition II, fish were treated and held in fresh water for 4 days before their medium was gradually changed over a 4-hour period to 28% seawater. In condition I, no mortality occurred among fish treated with 2,4-D, trichlorofon, simazine, quinaldine, or light to moderate dose of MS-222. About 10% mortality occurred among fish treated with formalin and nifurpirinol. High mortality in seawater followed treatments with copper sulfate, hyamine 1622, potassium permanganate, malachite green (one protocol), and heavy doses of MS-222. In condition II, mortality was reduced but still high for copper sulfate and potassium permanaganate, much lower for malachite green and hyamine 1622, and zero for the other agents. The results indicate that additional recoery time in fresh water is necessary between some treatments and exposure to salt water. (Katz-EIS)
W79-08295

RELEASE OF TRACE METALS BY SEWAGE SLUDGE AND THE SUBSEQUENT UPTAKE BY MEMBERS OF A TURTLE GRASS MANGROVE ECOSYSTEM,
Harbor Branch Foundation, Inc. Fort Pierce, FL.
For primary bibliographic entry see Field 5A.
W79-08296

ADSORPTION OF POLYCHLORINATED BIPHENYL ONTO SEA BED SEDIMENT, MARINE PLANKTON, AND OTHER ADSORBING AGENTS,
Tokyo Univ. (Japan). Dept. of Chemical Engineering.
Y. Hiraizumi, M. Takahashi, and H. Nishimura.
Environmental Science and Technology, Vol. 13, p 580-584, 1979. 6 fig, 2 tab, 14 ref.

Descriptors: *Polychlorinated biphenyls, PCB, *Sediment, *Marine plankton, Zooplankton, Phytoplankton, *Adsorption, Seawater, Laboratory tests, Adsorption capacity, Desorption rate, Laboratory test, Water pollution effects, Marine fish, Public health, Osaka Bay, Japan, Surfaces.

Adsorption of PCB onto sea bed sediment, sand, and previously dehydrated samples of plankton and other adsorbing agents was experimentally examined and compared with the results of field observations. Samples of zooplankton and phytoplankton were observed to reach their maximum PCB adsorption capacity within 100 to 200 min. However, the desorption rate was very slow. Batch studies, as well as field observations, indicate that PCB adsorption of various adsorbing agents correlates well with the PCB concentration in brine, and could be described by a Freundlich isotherm. The PCB concentration factors of the adsorbents were found to be inversely related to their average particle size and linearly related to their specific surface area for adsorbents of the same constituent. However, the organic content of the adsorbent also appeared to influence the PCB concentration factor. (Katz-EIS)
W79-08297

DEGRADATION OF DIAZINON BY SODIUM HYPOCHLORITE. CHEMISTRY AND AQUATIC TOXICITY,
Army Medical Bioengineering Research and Development Lab. Fort Detrick, MD.
For primary bibliographic entry see Field 5A.
W79-08298

THE IMPORTANCE OF SALINITY IN DETERMINING THE MORPHOLOGY AND COMPOSITION OF ALGAL MATS,
North Carolina Univ. at Chapel Hill. Curriculum in Marine Sciences.
For primary bibliographic entry see Field 5A.
W79-08299

INTENSIVE CULTURE OF TILAPIA WITH GEOTHERMALLY HEATED WATER,
Weisbart and Weisbart, Inc., Alamosa, CO. Fish Dept.
P. C. Laurenstein.
In: Culture of Exotic Fishes Symposium Proceedings p 82-85 1978. R. O. Smitherman, W. L. Shelton, J. H. Grover, eds., Fish Culture Section, American Fisheries Society, Auburn, Alabama.

Descriptors: *Tilapia, *Fish farming, *Thermal water, Geothermal studies, Water temperature, Fry, Growth rates, Fish reproduction, Spawning, Water chemistry, Fish diets, Fish populations, Aquiculture.

The main features of the tilapia farm in Alamosa, Colorado are a well supplying geothermally heated water at 26 degrees C, circular steel tanks, cement raceways, earthen raceways, and a round earthen pond. The farm requires 252 liters/sec to sustain 50 tons of tilapia (Tilapia aurea) stocked at 20 to 60 kg/cu m/hr. High flow is necessary to maintain the water temperature in raceways above 24C with ambient temperature as low as -32 degrees C in winter. Important fish production indices include feed conversion of 1.5:1, daily consumption of pelleted feed at 1 to 1.5% of body weight, and growth rate of 1 to 2 g/day. Unwanted spawning is not a problem in this flow-through system. (Deal-EIS)
W79-08300

PRODUCTION OF TILAPIA IN CATFISH RACEWAYS USING GEOTHERMAL WATER,
Fish Breeders of Idaho, Inc., Buhl.
L. E. Ray.
In: Culture of Exotic Fishes Symposium Proceedings p 86-89, 1978. R. O. Smitherman, W. L. Shelton, J. H. Grover, eds., Fish Culture Section, American Fisheries Society, Auburn, Alabama.

Descriptors: *Tilapia, *Fish farming, *Thermal water, Aquiculture, Geothermal studies, Water temperature, Growth rates, Fish populations, Fish diets, Predation, Fish reproduction, Spawning, Idaho.

There exists a market for Tilapia zillii to clean aquatic vegetation from water impoundments. Production technology to supply large numbers of reproductive age T. zillii for early spring stocking was developed. Problems incurred in producing tilapis during the winter including timing, predation, grading, and transportation are discussed. A second potential exists in the form of the food market for tilapis. Initial market testing has been very encouraging. (Deal-EIS)
W79-08301

TILAPIA PRODUCTION IN PONDS RECEIVING SWINE WASTES,
Texas A and M Univ., College Station. Dept. of Wildlife and Fisheries Sciences.
For primary bibliographic entry see Field 5E.
W79-08302

ALGAE-SWINE MANURE SYSTEM FOR PRODUCTION OF SILVER CARP, BIGHEAD CARP, AND TILAPIA,
Tennessee Valley Authority, Muscle Shoals, AL.
J. J. Maddox, L. L. Behrends, C. E. Madewell, and R. S. Pile.
In: Culture of Exotic Fishes Symposium Proceedings p. 109-120, 1978. 6 tab, 14 ref. R.O. Smitherman, W. L. Shelton, J. H. Grover, eds, Fish Culture Section, American Fisheries Society, Auburn, Alabama.

Descriptors: *Carp, *Hogs, *Fish farming, *Fish diets, *Fish food organisms, Domestic animals, Domestic wastes, Aquiculture, Animal groupings, Number fish per acre, Nutrients, Waste disposal, Algae, Aquatic algae, Growth rates, Seasonal, Tilapia.

Growth of naturally occurring algae species as a result of swine manure fertilization has been studied. Seasonal changes in species of algae have been observed. A 5-day growth period with manure diluted 340 times and used daily has proven successful to produce plankton in the summertime. Yield trials using this algae were conducted with silver carp, bighead carp, and tilapia. Silver carp in monoculture gained 253% and had a 79% survival in a 72-day study in 1976. A polyculture yield trial (52 days) was conducted in 1977 with all three species to measure their cumulative growth when fed algae exogenously produced and fertilized with swine manure, compared to growth produced by an equivalent amount of manure introduced directly into the fish culture. Fish production was 1.8 times greater when manure was introduced directly into the fish culture. Results are discussed with respect to cultural problems encountered and the potential for using such systems in warm waters discharged at power plants. (Deal-EIS)
W79-08303

AN EVALUATION OF THE FILTER FEEDING FISHES, SILVER AND BIGHEAD CARP, FOR WATER QUALITY IMPROVEMENT,
Arkansas Game and Fish Commission, Little Rock.
S. Henderson.
In: Culture of Exotic Fishes Symposium Proceedings p. 121-136, 1978. 9 fig, 5 ref. R.O. Smitherman, W. L. Shelton, J. H. Grover, eds, Fish Culture Section, American Fisheries Society, Auburn, Alabama.

Descriptors: *Water quality, *Waste water treatment, *Carp, Eutrophication, Fish diets, Plankton, Fish food organisms, Nutrients, Protein, Aquiculture, Sewage treatment, Fish farming, Water chemistry, Water quality control, Sewage lagoons, Oxidation lagoons, Growth rates, Nitrogen, Ammonia.

With the advent of stricter water quality standards has come the need for alternatives to expensive mechanical wastewater treatment methods. The silver (Hypophthalmichthys molitrix) and bighead carp (Aristichthys nobilis) filter feeding fishes were utilized in actual field tests to determine their capabilities in controlling excessive plankton blooms and converting nutrients found in wastewaters into usable protein. It was found that the presence of the fish did affect plankton removal and stimulate nutrient uptake. The feeding habits of these fishes make them capable of converting primary production into large amounts of fish flesh without supplemental feeding. The results of this first trial have provided the impetus for further research into this method of wastewater treatment which could be utilized in many instances, ranging from small town sewage treatment plants to lagoons receiving water discharged from fish farming operations. (Deal-EIS)
W79-08304

POLYCULTURE OF CHINESE CARPS IN PONDS WITH SWINE WASTES,
Illinois Natural History Survey, Kinmundy.
H. Buck, R. J. Baur, and C. R. Rose.
In: Culture of Exotic Fishes, Symposium Proceedings, p 144-153, 1978. 24 ref. R. O. Smitherman, W. L. Shelton, J. H. Grover, Eds. Fish Culture Section, American Fisheries Society, Auburn, Alabama.

Descriptors: *Carp, *Hogs, *Fish farming, *Fish diets, Domestic animals, Fish populations, Number fish per acre, *Aquiculture, Animal groupings, Domestic wastes, Nutrients, Waste disposal, Cultures, Biomass, Channel catfish, Bass, Recycling, Growth rates.

Through three growing seasons swine houses were situated so that the wastes dropped directly into ponds stocked with silver carp, bighead carp, grass carp, the Israeli variety of the common carp, channel catfish, and either the northern largemouth bass, or the bluegill. Two ponds were used in 1975, four in 1976 and 1977. Two consecutive lots of pigs were fattened over each pond in the April to October period of each season. The sole addition of nutrients to the ponds were the swine wastes. Water levels were lowered at mid-season in 1975 and 1976 to improve natural circulation, and were lowered and later raised in 1977, but conditions were otherwise static, with no artificial aeration or circulation. Over growing periods of from 170 to 197 days gains in fish biomass ranged from 788 kg/ha in a control pond which received no wastes to a maximum of 4585 kg/ha. Production of bighead carp was inversely correlated with that of silver carp, but gains in biomass by Israeli carp were directly correlated with total gains made by silver carp. Evidence was gained that there is an optimum density of carps, one large enough for effective nutrient removal, and efficient protein production, but not so large as to create undesirable levels of turbidities or metabolites. A total mortality occurred in one pond in late-season, 1976, but water quality was in most cases adequate for the survival of largemouth bass, or the reproduction and survival of bluegill. (Deal-EIS)
W79-08305

CONCENTRATION OF SILVER 110M IN A MARINE FOOD CHAIN. II. UPTAKE THROUGH THE FOOD CHAIN,
Nantes Univ. (France). Lab. de Biologie Marine.
For primary bibliographic entry see Field 5B.
W79-08306

HEAVY METALS IN RELATION TO THE BIOLOGY OF THE MUMMICHOG, FUNDULUS HETEROCLITUS,
Adelphi Univ., Garden City, NY. Dept. of Biology.
For primary bibliographic entry see Field 5A.
W79-08308

RESISTANCE TO CADMIUM BY PRETREATED RAINBOW TROUT ALEVINS,
University of Wales Inst. of Science and Technology, Cardiff. Dept. of Applied Biology.
D. Pascoe, and J. H. Beattie.
Journal of Fish Biology, Vol. 14, p 303-308, 1979. 1 fig, 2 tab, 31 ref.

Descriptors: Freshwater fish, *Metals, *Cadmium, *Toxicity, Bioassay, Laboratory tests, Rainbow trout, Juvenile fish, Mortalities, Survival period, Cadmium pretreatment, Methodology, Water chemistry, Animal physiology, Acclimation.

A toxicity test with cadmium concentrations ranging from 0.1 to 100.0 mg/l Cd was used to assess the effect of cadmium pretreatment on rainbow trout alevins. The median period of survival for fish pretreated at 0.1 mg/l Cd was found to be increased at test concentrations up to 10 mg/l Cd compared with alevins pretreated with dilution water. However, at concentrations above 10 mg/l Cd pretreatment at 0.01 mg/l Cd reduced the median period of survival. (Katz-EIS)
W79-08309

STRONTIUM MARKING OF HATCHERY-REARED COHO SALMON (ONCORHYNCHUS KISUTCH, WALBAUM),
Fisheries and Marine Service, Nanaimo (British Columbia). Pacific Biological Station.
For primary bibliographic entry see Field 5A.
W79-08310

ALTERATION IN ENZYME ACTIVITIES IN LIVER AND KIDNEY OF CHANNA PUNCTATUS EXPOSED TO ENDRIN,
D.A.V. Coll., Muzaffarnagar (India). Dept. of Zoology.
For primary bibliographic entry see Field 5B.
W79-08312

EFFECTS OF THE WATER-SOLUBLE FRACTION OF COOK INLET CRUDE OIL ON THE MARINE ALGA, DUNALLIELA TERIOLECTA,

California Univ., Bodega Bay. Bodega Marine Lab.
For primary bibliographic entry see Field 5A.
W79-08313

ENDRIN TOXICOSIS ON FEW ENZYMES IN LIVER AND KIDNEY OF CHANNA PUNCTATUS (BLOCH),
D.A.V. Coll., Muzaffarnagar (India). Dept. of Zoology.
For primary bibliographic entry see Field 5B.
W79-08315

FURTHER STUDIES ON THE TOXICITY OF DDT TO PLANARIA,
National Council for Scientific Research, Beirut (Lebanon). Marine Research Center.
For primary bibliographic entry see Field 5B.
W79-08316

THE IN VIVO EFFECT OF MERCURIC CHLORIDE ON SOME DIGESTIVE ENZYMES OF A FRESH WATER TELEOST FISH, CHANNA PUNCTATUS,
D.A.V. Coll., Muzaffarnagar (India). Dept. of Zoology.
For primary bibliographic entry see Field 5A.
W79-08317

EFFECTS OF CALCIUM ADDITION AS CA(NO3)2 ON ZINC TOXICITY TO FATHEAD MINNOWS, PIMEPHALES PROMELAS, RAFINESQUE,
North Texas State Univ., Denton. Dept. of Biological Sciences.
For primary bibliographic entry see Field 5A.
W79-08318

A COMPARATIVE STUDY OF THE EFFECT OF ACUTE AND CHRONIC MERCURIC CHLORIDE TREATMENT ON THE ACTIVITIES OF A FEW DIGESTIVE ENZYMES OF A TELEOST FISH, CHANNA PUNCTATUS,
D.A.V. Coll., Muzaffarnagar (India). Dept. of Zoology.
For primary bibliographic entry see Field 5A.
W79-08319

ALKANES IN FISH FROM THE BUCCANEER OILFIELD,
Houston Univ., TX. Dept. of Biophysical Sciences.
For primary bibliographic entry see Field 5A.
W79-08320

UPTAKE, TISSUE DISTRIBUTION, METABOLISM AND ELIMINATION N-OCTANO-1-14C-HYDROXAMIC ACID BY BROOK TROUT,
Bedford Inst. of Oceanography, Dartmouth (Nova Scotia).
For primary bibliographic entry see Field 5A.
W79-08321

MERCURIC CHLORIDE INDUCED ENZYMOLOGICAL CHANGES IN KIDNEY AND OVARY OF A TELEOST FISH, CHANNA PUNCTATUS,
D. A. V. Coll., Muzaffarnagar (India). Dept. of Zoology.
For primary bibliographic entry see Field 5B.
W79-08323

EFFECTS OF LEAD NITRATE ON THE ACTIVITIES OF A FEW ENZYMES IN THE KIDNEY AND OVARY OF HETEROPNEUSTES FOSSILIS,
D. A. V. Coll., Muzaffarnagar (India). Dept. of Zoology.
For primary bibliographic entry see Field 5A.
W79-08324

ACCUMULATION OF POLYCHLORINATED BIPHENYL (PHENOCLOR DP6) BY ESTUARINE FISH,
Bordeaux Univ., Talence (France). Lab. de Physiologie de la Nutrition.
For primary bibliographic entry see Field 5A.
W79-08325

EFFECTS OF CRUDE AND DIESEL OIL SPILLS ON PLANT COMMUNITIES AT PRUDHOE BAY, ALASKA, AND THE DERIVATION OF OIL SPILL SENSITIVITY MAPS,
Colorado Univ., Boulder. Inst. of Arctic and Alpine Research.
D. A. Walker, P. J. Webber, K. R. Everett, and J. Brown.
Arctic, Vol. 3, p 242-259, 1978. 4 fig, 3 tab, 29 ref.

Descriptors: *Oil, *Oil spills, Water pollution effects, Alaska, Arctic, Prudhoe Bay, *Plant communities, Aquatic plants, *Plant groupings, Plant growth, Plant populations, Sedges, Willow trees, Moss, Lichens, Mortalities, Oil sensitivity maps, Crude oil, Diesel oil.

Crude oil was spilled on six of the major Prudhoe Bay plant communities at an intensity of 12 l/sq. m. The communities occurred along a topographic-moisture gradient. The reaction of the major species of the various communities was recorded one year following the spills. Sedges and willows showed substantial recovery from crude oil spills. Mosses, lichens, and most dicotyledons showed little or no recovery. On a very wet plot with standing water, the vegetation showed total recovery one year following the spill. Dry plots on the other hand, showed very poor recovery. Dryas integrifolia M. Vahl, the most important vascular species on dry sites, was killed. Identical experiments using diesel oil rather than crude oil showed all species except an aquatic moss to be killed. A sensitivity index for the communities was calculated on the basis of the percentage cover of the resistant species divided by the original total plant cover of the community. With this information an oil spill sensitivity map for an area of Prudhoe Bay was constructed using a vegetation map as a base. Using the crude oil data from Prudhoe Bay together with some from the literature, a predictive sensitivity map was also constructed for an accidental crude oil spill at nearby Franklin Bluffs. In this example all the community types are considered to have moderate to excellent recovery potential. (Katz-EIS)
W79-08326

POLYCHLORINATED BIPHENYL ACCUMULATION IN GREY MULLETS (CHELON LABROSUS): EFFECT OF AGE,
Bordeaux Univ., Talence (France). Lab. de Physiologie de la Nutrition.
For primary bibliographic entry see Field 5A.
W79-08327

ACUTE TOXICITY OF CADMIUM, COPPER, AND MERCURY TO LARVAL AMERICAN LOBSTER HOMARUS AMERICANUS,
Environmental Research Lab., Narragansett, RI.
For primary bibliographic entry see Field 5A.
W79-08328

MASS DEVELOPMENT OF THE PHYTOFLAGELLATE PRYMMESIUM PARVUM CARTER (HAPTOPHYCEAE) IN A COASTAL LAGOON IN THE EBRO DELTA (DESARROLLO MASIVO DEL FITOFLAGELADO PRYMNESIUM PARVUM CARTER (HAPTOPHYCEAE) EN UNA LAGUNA COSTERA DEL DELTA DEL EBRO),
Barcelona Univ. (Spain). Dept. de Ecologia.
For primary bibliographic entry see Field 5A.
W79-08330

TOXICITY OF PRUDHOE BAY CRUDE OIL TO ALSKAN ARCTIC ZOOPLANKTON,
Kansas Univ., Lawrence. Dept. of Systematics and Ecology.
W. J. O'Brien.
Arctic, Vol. 31, p 219-228, 1978. 2 tab, 2 fig, 30 ref.

Descriptors: *Oil, *Oil spill, *Toxicity, Bioassay, Laboratory test, Water pollution effects, Arctic, Alaska, Prudhoe Bay Crude Oil, *Zooplankton, Crustacean, Daphnia, Phyllopoda, Fairy shrimp, Copepoda, Methodology.

Bioassay experiments were conducted to determine the relative susceptibilities of three arctic zooplankton species to oil pollution, and the results were compared with the effects of an actual oil spill on a pond near Barrow. In both the bioassays and the pond, the addition of Prudhoe Bay crude oil was toxic to fairy shrimp (Branchionecta paladosa), which seemed most sensitive, Daphnia middendorffiana, which was next most susceptible and Heterocope septentrionalis which appeared somewhat resistant to the effects of oil. Cyclopoid copepods were the only common zooplankters able to survive the pond oil spill, and these were still present two and one half weeks after the spill. The rapid deaths of the other species, especially the branchiopods, suggest that zooplankton may be the most susceptible of all arctic freshwater organisms to oil pollution. (Katz-EIS)
W79-08331

CARP (C1-2) OVERWINTERING AND BREEDING IN COOLING WATERS, (IN POLISH),
Instytut Akwakultury i Techniki Rybackiej, Szczecin (Poland).
R. Trzebiatowski, J. Filipiak, and R Jakubowski.
Zeszty Naukowe Akademii Rolniczej w Szczecinie, No. 70, p 51-61, 1978. 5 fig, 1 tab, 9 ref. (English Summary).

Descriptors: *Carp, Fresh water fish, *Aquiculture, Water pollution effects, Commercial fisheries, Poland, *Thermal water, *Water temperature, *Power plants, Cooling waters, On-site-investigations, Bioassay, Growth rates, Fish farming, Fish harvest, Fish hatcheries, Fish reproduction.

Studies on carp breeding in the Dolna Odra power station cooling waters were carried out within January 12 -August 23, 1976; their aim was to prove a possibility of young carp overwintering in cages placed in a cooling canal and of reproduction over the growth season. Over the experimental period, the water temperature ranged with 3,5-33.0 degrees C, frequent and substantial changes (up to 12 degrees C) during a day having been discovered. The water pH values changed within a relatively narrow range of 7.3-8.2. The water oxygenation range was 76 - 118%, 90% being the most frequent level. Fish growth rate recorded over the winter months (till the end of April) was low and basically, between the control weighings, did not exceed 10% of fish weight. Beginning from May, the increments were higher (10-35% showing a clear relationship to the water temperature (optimal growth at 24-27 degrees C). The results obtained confirmed a possibility of using the cooling waters for carp overwintering and breeding; on account of their continuous feeding in winter , the carp reared increased their body weight and improved their condition. (Katz-EIS)
W79-08332

HYDROCARBONS AND MICROBIAL ACTIVITIES IN SEDIMENT OF AN ARCTIC LAKE ONE YEAR AFTER CONTAMINATION WITH LEAD GASOLINE,
Louisville Univ., KY. Dept. of Biology.
A. Horowitz, A. Sexstone, and R. M. Atlas.
Arctic, Vol. 31, p 180-191, 1978. 1 fig, 6 tab, 6 ref.

Descriptors: *Oil, *Oil spill, Water pollution effects, Arctic, Lake, *Lead, Metals, *Leaded gasoline, Alaska, Point Barrow, Gasoline contamination, Hydrocarbons, Sediment, Nitrogen fixation, Nitrogen fixing bacteria, Naval Arctic Research Laboratory, On-site investigation, Denitrification.

Hydrocarbons were found to persist in the sediment of an Arctic lake one year after the lake was accidentally contaminated with leaded gasoline. The contaminating gasoline was continuing to spread from the original site of contamination. High numbers of hydrocarbon utilizing microorganisms were found in the contaminated sediment. Rates of nitrogen fixation did not appear to be affected by hydrocarbon contamination, but potential denitrification activities appeared to be altered

by the gasoline. Fertilizer application resulted in a moderate decrease of hydrocarbon concentrations in the sediment. (Katz-EIS)
W79-08333

CRUDE OIL BIODEGRADATION IN ARCTIC TUNDRA PONDS,
Cincinnati Univ., OH. Dept. of Biological Sciences.
P. E. Bergstein, and J. R. Vestal.
Arctic, Vol. 31, p 158-169, 1978. 8 fig, 20 ref.

Descriptors: *Oil, *Oil spills, Water pollution effects, Bacteria, *Arctic, *Tundra, Ponds, *Degradation(Decomposition), Crude oil, Nutrients, Fertilizers, Phosphate, Oleophilic phosphates, Microbiology, Microorganisms, On-site-investigations, Biodegradation, Oil degrading bacteria.

The degradation of Prudhoe crude oil was studied in arctic tundra ponds. Contained subponds were treated with oil and/or oleophilic phosphate or inorganic phosphate fertilizers in an attempt to enhance the degradation of the oil by the indigenous microflora. Enumeration studies of water and sediment samples indicated that oil treatment alone did not increase numbers of total heterotrophic or oil-degrading bacteria over a short period (28 days). It was also shown that oil spilled years previously on 2 whole ponds at a high (10 l/sq m) and a low dose (0.24 l/sq m) did not alter the microflora quantitatively, except in a small core spilled with oil. Although oil alone seemed to exhibit neither stimulatory nor toxic effects, oleophilic phosphate, added weekly at a concentration of 0.1 mM, significantly stimulated the microflora in the presence or absence of oil. Since equal concentrations of inorganic phosphate failed to induce this effect, the stimulation was attributed to the hydrocarbon portion of the organic phosphate molecule. 14C-hydrocarbon mineralization studies demonstrated that the microflora would mineralize the saturate fraction of the oil before the polyaromatic fraction. It was concluded that oleophilic fertilizers may provide a useful tool to enhance the biodegradation of crude oil spilled on oligotrophic waters. (Katz-EIS)
W79-08334

EFFECT OF PETROLEUM HYDROCARBONS ON MICROBIAL POPULATIONS IN AN ARCTIC LAKE,
Marine Biological Lab. Woods Hole, MA. Ecosystems Center.
For primary bibliographic entry see Field 5A.
W79-08335

LETHAL EFFECT OF GYMNODINIUM SP. ON THE ROTIFER, BRACHIONUS PLICATILIS (IN JAPANESE),
Nagasaki Univ. (Japan). Faculty of Fisheries.
For primary bibliographic entry see Field 5A.
W79-08336

PHYTOPLANKTON WATER QUALITY RELATIONSHIPS IN U.S. LAKES, PART I: METHODS, RATIONALE, AND DATA LIMITATIONS,
Nevada Univ., Las Vegas. Dept. of Biological Sciences.
W. D. Taylor, L. R. Williams, S. C. Hern, V. W. Lambou, and F. A. Morris.
Report No. EPA-600/3-79-021, March 1979. 77 p, 21 fig, 6 tab, 25 ref, 3 append.

Descriptors: *Phytoplankton, *Aquatic microbiology, *Aquatic microorganisms, *Lakes, Water quality, Eutrophication, Water chemistry, Nutrients, Bioindicators, Environment, Classification, Data collections, Data storage and retrieval, National Eutrophication Survey.

The National Eutrophication Survey (NES) sampled 815 lakes in the 48 contiguous states during the spring, fall, and summer of 1972 through 1975. To determine phytoplankton water quality relationships, the physical, chemical, and biological data measured were merged, and the environmental requirements and relative importance of phytoplankton forms were established. The methodology, rationale, output format, and data limitations of the product are presented in this report, Part I. The physical, chemical and morphometric conditions of 250 lakes in 17 eastern states sampled during 1973 are summarized on a seasonal basis and organized according to phytoplankton numerical dominance or non-dominance and occurrence or non-occurrence. The knowledge provided in these summaries of the specific requirements or environmental limits for each taxon can be used to develop biological tools for monitoring and predicting water quality or trophic condition. (See W79-08343 and W79-08344) (Davison-IPA)
W79-08342

PHYTOPLANKTON WATER QUALITY RELATIONSHIPS IN U.S. LAKES PART II: GENERA ACANTHOSPHAERA THROUGH CYSTODINIUM COLLECTED FROM EASTERN AND SOUTHEASTERN LAKES,
Nevada Univ., Las Vegas. Dept. of Biological Sciences.
L. R. Williams, S. C. Hern, V. W. Lambou, F. A. Morris, and M. K. Morris.
Report No. EPA-600/3-79-022, March 1979. 127 p, 2 tab, 21 ref, 1 append.

Descriptors: *Aquatic microbiology, *Phytoplankton, *Lakes, *Eutrophication, Water quality, Bioindicators, Biology, Water chemistry, Nutrient requirements, National Eutrophication Survey.

Findings for the first 54 genera of the phytoplankton detected in samples from 17 eastern and southeastern states are presented as determined from the National Eutrophication Survey conducted in 1973. The environmental requirements and relative abundance of Acanthosphaera through Cystodinium given in the appendix are a computer generated summary. (See also W79-08342) (Davison-IPA)
W79-08343

PHYTOPLANKTON WATER QUALITY RELATIONSHIPS IN U.S. LAKES PART III: GENERA DACTYLOCOCCOPSIS THROUGH GYROSIGMA COLLECTED FROM EASTERN AND SOUTHEASTERN LAKES,
Nevada Univ., Las Vegas. Dept. of Biological Sciences.
S. C. Hern, V. W. Lambou, F. A. Morris, M. K. Morris, and W. D. Taylor.
Report No. EPA-600/3-79-023, March 1979. 93 p, 2 tab, 21 ref, 1 append.

Descriptors: *Phytoplankton, *Aquatic microbiology, *Lakes, *Eutrophication, Water quality, Bioindicators, Biology, Water chemistry, Nutrient requirements, National Eutrophication Survey.

Findings for 34 genera of the phytoplankton detected in samples from 17 eastern and southeastern states are presented as determined from the National Eutrophication Survey conducted in 1973. The environmental requirements and relative abundance of Dactylococcopsis through Gyrosigma given in the appendix are a computer generated summary. (See also W79-08342) (Davison-IPA)
W79-08344

DETERMINING FISH AVOIDANCE OF POLLUTED WATER,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Biology.
S. R. Larrick, K. L. Dickson, D. S. Cherry, and J. Cairns, Jr.
Hydrobiologia, Vol. 6, No. 3, p 257-265, 1978. 1 tab, 60 ref.

Descriptors: *Fish behavior, *Water pollution effects, *Experimental equipment, *Laboratory test, Toxicity, Water pollution, Chlorine, Minnows, Bioassay, Bioindicators, Water analysis, Water quality.

Investigators have used several laboratory techniques and experimental troughs to study the behavioral responses of fish to polluted water. The merits and shortcomings of behavioral studies are evaluated, and methods with distinct advantages are proposed in an effort towards standardization of fish avoidance studies. The designs of various experimental troughs are reviewed. These troughs fall into two categories: those producing shallow gradients, and those producing steep gradients. Experiments performed with fathead minnows in a steep gradient of hypochlorite are discussed. Fish respond in several ways once a toxicant has been perceived. In a kinesis, the simplest response, the fish's body is not oriented with respect to the source of stimulation. Taxes, more advanced movements, direct a fish toward or away from a stimulant. Stott and Cross (1973) concluded that directed action of fish dominated the response of each to low oxygen conditions. The fathead minnows demonstrated most of these behavior patterns. Selecting a method of studying fish avoidance behavior and the choice of test organisms are examined. It is concluded that few methodologies incorporate all desirable features, but the steep gradient apparatus described has many useful modifications for determining fish behavior under adverse conditions. (Davison-IPA)
W79-08351

CAMP BRANCH AND CROSS CREEK EXPERIMENTAL WATERSHED PROJECTS: OBJECTIVES, FACILITIES, AND ECOLOGICAL CHARACTERISTICS,
Tennessee Valley Authority, Muscle Shoals, AL.
J. M. Kelly.
Report Nos. EPA-600/7-79-053 and TVA/ONR-79/04, March 1979. 162 p, 14 fig, 86 tab, 15 ref, 8 append. E-AP 80 BDO.

Descriptors: *Ecosystems, *Watersheds(Basins), Ecology, Biological communities, Camp Branch Watershed, Cross Creek Watershed, Basins, Soil tests, Soil analysis, Trees, Environmental effects, Hydrology, Limnology, Biochemistry, Pollutants, Soils, Air pollution, Water pollution, Widows Creek Power Plant.

Two experimental watersheds in the eastern U.S. were used to study and evaluate the impact of antropogenic emissions on individual ecosystem processes and the integrated response of the total system. The biotic and edaphic characteristics of each study site are documented. Because of the inherent variabilities of these systems, several long- and short-term studies were integrated into the watershed approach to evaluating biogeochemical processes. The Cross Creek watershed occupies a total of 36 ha and has been subjected to about 30 years of sulfur and nitrogen input from a coal-fired power plant. The Camp Branch watershed occupies 94 ha in a relatively remote area, away from the influence of any major anthropogenic sulfur or nitrogen source. A comparative study of the two sites contributed needed information on the cycling of chemical elements in natural systems. It also enables the construction of empirical models with which to predict the ecological effects of man's activities. Data gathered can be used to guide the legislative process in determining and promulgating atmospheric emission standards. (Schaefer-IPA)
W79-08357

RUNOFF WATER QUALITY FROM VARYING LAND USES IN SOUTHEASTERN ARIZONA,
Science and Education Administration, Tucson, AZ. Southwest Rangeland Watershed Research Center.
For primary bibliographic entry see Field 5A.
W79-08372

TRACE METALS AND MARINE PRODUCTION PROCESSES. PROCEEDINGS OF A WORKSHOP HELD AT THE PACIFIC MARINE ENVIRONMENTAL LABORATORY FEBRUARY 28 - MARCH 2, 1978,
National Ocean and Atmospheric Administration, Seattle, WA. Pacific Marine Environmental Lab.
NOAA Special Report, January 1979. 27 p, 1 tab, 70 ref. Also as Pacific Marine Environmental Laboratory Contribution No. 385.

Descriptors: *Estuaries, *Ecosystems, *Coasts, *Water pollution effects, Metals, Toxicity, Analyt-

ical techniques, Pollutant identification, Trace metals.

As part of a program studying the long-range effects of pollution the Pacific Marine Environmental Laboratory, one of the Environmental Research Laboratories of NOAA, conducted a workshop to prepare recommendations for research on the effects of trace metals on estuarine and coastal ecosystems. The significant recommendations are the following: (1) laboratory studies should concentrate on developing analytical procedures for determining the concentrations and principal species of trace metals in coastal waters and producing dose-response curves for different biological species exposed to selected metal species; (2) field studies should be devoted to determining actual concentrations and speciation of trace metals and exchanges of these trace metals between dissolved and particulate phases, and the effect of specific trace metal species on the species succession of natural populations of marine phytoplankton; and (3) chemical models should be developed to predict the effects of anthropogenic inputs of trace metals to coastal waters. (NOAA)
W79-08381

BACTERIA CRITERIA,
Environmental Protection Agency, Washington, DC. Div. of Water Quality Standards.
For primary bibliographic entry see Field 5A.
W79-08403

OUTER CONTINENTAL SHELF LANDS ACT AMENDMENTS OF 1977.
Energy and Natural Resources Committee (U.S. Senate), Washington, DC.
For primary bibliographic entry see Field 6E.
W79-08404

TEMPERATURE (TEMPERATURE STANDARDS FOR NATIONWIDE WATER QUALITY MANAGEMENT).
Environmental Protection Agency, Washington, DC. Div. of Water Quality Standards.
For primary bibliographic entry see Field 4C.
W79-08425

MIXING ZONES (RECOMMENDATIONS FOR A NATIONWIDE STRATEGY FOR WATER QUALITY MANAGEMENT).
Environmental Protection Agency, Washington, DC. Div. of Water Quality Standards.
For primary bibliographic entry see Field 5A.
W79-08428

WILLAMETTE BASIN COMPREHENSIVE STUDY OF WATER AND RELATED LAND RESOURCES: APPENDIX L--WATER POLLUTION CONTROL,
Pacific Northwest River Basins Commission, Portland, OR. Willamette Basin Task Force.
For primary bibliographic entry see Field 5A.
W79-08445

CONTROL OF FOULING ORGANISMS IN ESTUARINE COOLING WATER SYSTEMS BY CHLORINE AND BROMINE CHLORIDE,
Academy of Natural Sciences of Philadelphia, Benedict, MD. Benedict Estuarine Research Lab.
D. T. Burton, and S. L. Margrey.
Environmental Science & Technology, Vol. 13, No. 6, p 684-689, 1979. 6 fig, 2 tab, 30 ref.

Descriptors: *Chlorine, *Chlorination, *Bromine, *Chesapeake Bay, *Toxicity, Bioassay, Fouling benthos, Animal communities, *Power plants, Halogens, Water pollution effects, Fouling communities, Water quality, Bromine chloride, Intermitent chlorination, On-site-investigations, Maryland.

The relative antifouling effectiveness of chlorine and bromine chloride under intermittent and continuous modes of application in low velocity flow areas was evaluated at an estuarine power plant located on the Chesapeake Bay. No significant difference in the control of fouling organisms was found on the average between similar concentrations of chlorine and bromine chloride. Significant differences in fouling were found between intermittent and continuous halogenation on both clean and prefouled surfaces. Continuous halogenation was more effective over an entire fouling season in controlling primary, secondary, and adventitious fouling communities than intermittent halogenation for periods up to 2 h per day. Continuous halogenation at 0.3 mg/L total residual halogen was more effective than 0.1 mg/L total residual halogen during late spring and summer; no difference was found between the two concentrations during the early fall. (Katz-EIS)
W79-08449

CADMIUM BIOACCUMULATION ASSAYS. THEIR RELATIONSHIP TO VARIOUS IONIC EQUILIBRIA IN LAKE SUPERIOR WATER,
Environmental Research Lab.-Duluth, MN.
J. E. Poldoski.
Environmental Science & Technology, Vol. 13, No. 6, p 701-706, 1979. 1 fig, 5 tab, 26 ref.

Descriptors: *Metals, *Cadmium, *Zooplankton, *Daphnia, *Bioaccumulation, Water quality, Chemical analysis, *Chemical properties, Chemical reactors, Humic acids, Bioaccumulated cadmium, Complexing agents, Bioassay, Laboratory tests, Ions, *Lake Superior, Water pollution effects, Metal uptake, Methodology.

The potential use of bioaccumulation by Daphnia magna as an analytical tool in studying properties of various aqueous cadmium forms is described. Selected aquatic chemical factors affecting cadmium residues were determined for organisms exposed to cadmium in the absence and presence of various organic and inorganic chemicals, some capable of strongly complexing cadmium. Without any added complexing agents, steady-state relationships were observed between total aqueous cadmium concentrations and bioaccumulated cadmium (0.09-3.2 micrograms wet weight) within 2-4 days of exposure. Residues were a nonlinear function of the concentration. The presence of humic acid, pyrophosphate, or aminopolycarboxylic acids, at sufficient concentrations to maximize complexation, was effective - to various degrees-in reducing cadmium uptake. However, cadmium in the presence of diethyldithiocarbamate bioaccumulated to a greater degree than in its absence. (Katz-EIS)
W79-08450

THE STRUCTURE OF MEIOFAUNA COMMUNITIES,
Oslo Univ. (Norway). Inst. for Marine Biology.
For primary bibliographic entry see Field 5A.
W79-08451

IMPINGEMENT SAMPLING FREQUENCY. A MULTIPLE POPULATION APPROACH,
Lawler, Matusky, and Skelly, Tappan, NY.
For primary bibliographic entry see Field 5A.
W79-08452

DETERMINATION OF SEVERAL INDUSTRIAL AROMATIC AMINES IN FISH,
Food and Drug Administration Washington, DC. Div. of Chemical Technology.
For primary bibliographic entry see Field 5A.
W79-08453

THE RECOVERY AND HEMATOLOGICAL REHABILITATION OF CHLORINE STRESSED ADULT RAINBOW TROUT (SALMO GAIRDNERI),
Consumers Power Co., Jackson, MI. Dept. of Environmental Services.
I. H. Zeitoun.
Environmental Biology of Fishes, Vol. 3, No. 4, p 355-359, 1978. 3 tab, 24 ref.

Descriptors: *Chlorine, *Toxicity, Bioassay, Mortality, Fish physiology, Rainbow trout, Freshwater fish, *Fish blood, Hematology, Stress, Hemolysis, Plasma electrolytes, *Water temperature, Laboratory test, Total residual chlorine, Water pollution effects.

The ability of adult trout (Salmo gairdneri) to recover from acute chlorine exposure was tested. Six separate tests were carried out in duplicate. Blood was collected from each duplicate group of fish at the beginning of the test, at the appearance of the chlorine-distress symptoms, and at 24 and 48 h after exposures. The total residual chlorine (TRC) concentrations used in these six tests were 1.67, 3.50, 1.10, 1.25, 1.02 and 0.0 mg/l, at water temperatures of 13.5, 14.6, 17.2, 22.6, 23.0 and 26.0 degrees C, respectively. The cumulative fish mortality for these six tests at 48 h after exposure were 11.5, 100, 0.0, 67.1, 36.1 and 100 percent. Blood of chlorine stressed fish exhibited signs of hemoconcentration and hemolysis. All blood parameters with the exception of hemolysis returned to control levels within 24 hours after exposure. High TRC concentrations in the range of 3.5 mg/l at 14.0 degrees C, and TRC of 1.25 and 1.02 mg/l TRC at 23 degrees C, significantly diminished the rainbow trout recovery. (Katz-EIS)
W79-08454

LONG-TERM EFFECTS OF ZINC EXPOSURES ON BROOK TROUT (SALVELINUS FONTINALIS),
Environmental Research Lab.-Duluth, MN.
G. W. Holcombe, D. A. Benoit, and E. N. Leonard.
Transactions of the American Fisheries Society, Vol. 108, p 76-87, 1979. 2 fig, 3 tab, 38 ref.

Descriptors: *Metals, *Zinc, Water pollution effects, *Path of pollutants, Brook trout, Fresh water fish, *Lake Superior, Bioassay, Laboratory tests, Fish eggs, Juvenile fish, Maximum accepted toxicant concentration, Water quality, Zinc loss, Tissue concentrations.

Exposure of three generations of brook trout (Salvelinus fontinalis) to zinc concentrations ranging from 2.6 to 534 micrograms/liter produced no significant harmflu effects. During a separate exposure of embryos and larvae, 1,368 micrograms Zn/liter significantly reduced both embryo and 12-week larval survival. An additional partial chronic exposure also resulted in signifantly reduced egg chorion strength and embryo survival at 1,360 micrograms Zn/liter. The maximum acceptable toxicant concentration (MATC) for brook trout exposed to zinc in Lake Superior water (hardness = 45.4 mg/liter as CaCO3; pH = 7.0-7.7). Brook trout gill, liver, kidney, and opercular bone tissues accumulated the greatest amounts of zinc. Edible muscle tissue did not accumulate zinc. Zinc loss from gill and liver from first-generation trout transferred to control water for 12 weeks was 55% and 59%, respectively, based on the total micrograms of zinc per whole tissue. Zinc in kidney tissue (based on the total micrograms of zinc per whole tissue) increased 192%, however, during the 12 weeks in control water. (Katz-EIS)
W79-08455

ARSENIC CONCENTRATIONS IN WATER AND FISH FROM CHAUTAUQUA LAKE, NEW YORK,
State Univ. of New York Coll. at Buffalo. Dept. of Biology.
For primary bibliographic entry see Field 5A.
W79-08456

MERCURY IN HERONS, EGRETS, AND THEIR FOODS,
Ohio Cooperative Wildlife Research Unit, Columbus.
R. D. Hoffman, and R. D. Curnow.
Journal of Wildlife Management, Vol. 43, No. 1, p 85-93, 1979. 5 tab.

Descriptors: *Mercury, Metals, Water pollution effects, Food chain, *Lake Erie, Freshwater fish, *Water birds, Great Blue Heron, Black-Crowned Night Heron, Great Egret, Tissue concentration, Trophic level, Food chain, Food habits, Food items, Public health.

Mercury concentration levels were measured in herons and egrets and their foods collected in the southwestern Lake Erie region. We analyzed primary wing feathers, breast muscle, liver and brain tissues from 42 great blue herons, 44 black-crowned night herons, and 43 great egrets. Concentrations were higher in island nesting birds than birds collected at the Winous Point Shooting Club, with primary wing feathers the highest, followed by liver, breast muscle, and brain tissues. Mercury levels in breast muscle, liver and brain tissue of adult birds correlated ($P<0.01$) within each population. Tissues of adult birds exhibited higher ($P<0.05$) mercury concentrations than did tissues from nestlings of the same population. An importance index for each population of birds showing the significance of individual food items as sources of mercury indicated that birds nesting on West Sister Island acquired mercury from fish species found more frequently in Lake Erie than in marshes. (Katz-EIS)
W79-08457

EFFECTS OF ALDRIN EXPOSURE ON SNOW GEESE IN TEXAS RICE FIELDS,
Fish and Wildlife Service, Victoria, TX. Gulf Coast Field Station.
E. L. Flickinger.
Journal of Wildlife Management, Vol. 43, No. 1, p 94-101, 1979. 3 tab, 15 ref.

Descriptors: *Water birds, *Mortality, Toxicity, On-site-investigation, Pesticides, Aldrin, *Chlorinated hydrocarbon pesticides, Public health, *Snow geese, Texas, Garwood Prairie, Agricultural chemicals, Rice fields, Pesticide residues.

In 1972 and 1974, 112 dead or moribund snow geese (Chen c. caerulescens), mostly immature white-phase males, were found in a study area on the Garwood Prairie, Texas. Dying geese were observed within 2 days after rice fields planted with aldrin-treated seed were flooded by heavy rains on 21 March 1972 and 25 March 1974. Brains from 8 snow geese that were moribund when found contained an average of 8.2 ppm (4.9-14.0 ppm) of dieldrin (a metabolite of aldrin); brains of 14 geese found dead contained an average of 14.1 ppm (2.1-31 ppm). Because no mortalities occurred in 1973 when aldrin-treated rice seed was flooded after all geese had migrated or in 1975 and 1976 after the treatment of rice seed with aldrin was suspended, it appears certain that aldrin caused the mortalities. (Katz-EIS)
W79-08458

EFFECT OF L-DOPA, BROMOCRIPTON AND LERGOTRILE ON PROLACTIN CELL ACTIVITY AND HYDROMINERAL REGULATION IN YEARLING COHO SALMON, ONCORHYNCHUS KISUTCH,
Guelph Univ. (Ontario). Dept. of Zoology.
J. F. Leatherland.
Environmental Biology of Fish, Vol. 3, No. 4, p 385-388, 1978. 1 fig, 1 tab, 19 ref.

Descriptors: *Coho salmon, *Fish physiology, *Biochemistry, Fish behavior, Fish migration, Freshwater fish, Osmosis, Osmotic pressure, L-DOPA, Bromocripton, Lergotrile, Fish hatchery, Chemical analysis, Salmonids, Ontario, Bioassay, Laboratory tests, Water pollution effects, Prolactin.

The prolactin inhibiting substances L-DOPA, Lergotrile and Bromocripton appeared to reduce the secretory activity of the prolactin cells in coho salmon (Oncorhynchus kisutch) yearlings acclimated to distilled water and effected significant reductions in plasma osmotic pressure and plasma Na+ and/or Cl- concentrations. This suggests that in coho salmon prolactin is involved in osmotic or ionic homeostasis in hyposmotic environments in a manner similar to that in other teleosts. (Katz-EIS)
W79-08459

STRUCTURE OF THE YOLKSAC EPITHELIUM AND GILLS IN THE EARLY DEVELOPMENTAL STAGES OF RAINBOW TROUT (SALMO GAIRDNERI) MAINTAINED IN DIFFERENT AMBIENT SALINITIES,
Guelph Univ. (Ontario). Dept. of Zoology.
A. C. Y. Shen, and J. F. Leatherland.
Environmental Biology of Fishes, Vol. 3, No. 4, p 345-354, 1978. 19 fig, 30 ref.

Descriptors: *Rainbow trout, *Salinity, Freshwater fish, Juvenile fish, Juvenile growth stage, *Fish eggs, Laboratory tests, Yolksac, Osmosis, Ambient salinity, Laboratory tests, Osmotic regulation, Embryo, Alevin, *Fish physiology.

Small numbers of 'mitochondria-rich' ('chloride') cells were found in the yolksac epithelium of rainbow trout (Salmo gairdneri) embryos just before hatching and in eleutheroembryos up to 14 days after hatching. This suggests that the yolksac epithelium may play a limited ionoregulatory role in this species. 'Mitochondria-rich' cells were also present in small numbers in the branchial epithelium of embryos just before hatching and in increasing numbers in eleutheroembryos during the first two weeks after hatching. The cells in the branchial epithelium showed marked variations in appearance, particularly in the fine structure of the tubular (smooth) endoplasmic reticulum. Few of the mitochondria-rich cells examined here had the pitted apex which is characteristic of homologous cells in other species. There appeared to be no differences in the numbers or appearance of 'mitochondria-rich' cells in embryos and eleutheroembryos reared in different ambient salinities (distilled water, 11% and 13% sea water), possibly indicating that the genesis of the ionoregulatory function of the gills has not occurred at that interval of development. (Katz-EIS)
W79-08460

GROWTH OF RAINBOW TROUT FED ON VARIOUS PORTIONS OF FOOD IN COOLING WATERS, (IN POLISH),
Instytut Akwakultury i Techniki Rybackiej, Szczecin (Poland).
R. Trzebiatowski, J. Domagala, J. Filipiak, and R. Jakubowski.
Zeszyty Naukowe Akademii Roliniczej w Szczecinie, No. 70, p 63-72, 1978. 3 fig, 1 tab, 16 ref. (English summary).

Descriptors: *Rainbow trout, Freshwater fish, *Aquiculture, *Water temperature, *Power plants, Cooling water, Poland, Dolna Odra Power Station, Fish growth, Fish diets, *Gas-bubble disease, Supersaturation, Fish diseases, Fish farming, Fish physiology, Hydrogen ion concentration, Water quality, Optimal diet, Water pollution effect.

Studies aimed at determining the optimal food portion in feeding rainbow trout kept in the 'Dolna Odra' power station cooling waters were carried out within Dec. 2, 1976 - April 7, 1977. The experiments were run in 4 variants, each in 3 replicates. Each cage hold 3 cubic meters of water. The juvenile fish stock, ca 20 g original individual weight was 600 ind./cubic meters. A daily food portion in each variant was 2.0, 3.5, 5.0 and 6.5% of actual fish weight. During the experimental period, water temperature, pH, and oxygen saturation ranged within 8.0-20.0 degrees C, 5.8-8.4, and 74.1-107.2%, respetively. After 127 days in culture, a mean individual fish weight increased by a factor of 3.8, 7.2, 9.4, and 9.9 in the variant I, II, III and IV, respectively. The respective values of food coefficients were: 2.37, 1.79, 1.96, 2.29. The gas disease occurring periodically in fishes caused some mortality, inversely proportional to their feeding intensity; the per cent survival was 58.82, 83.46, 89.65, and 91.08 in the variant I, II, III, and IV, respectively. The data obtained indicate the fish condition to play a considerable role in surviving the gas disease. The optimal food portion in feeding rainbow trout kept in cooling waters (14-20 degrees C) was found to be about 5% of fish weight. (Katz-EIS)
W79-08461

EFFECTS OF CRUDE OIL ON AQUATIC INSECTS OF TUNDRA PONDS,
North Carolina State Univ. at Raleigh. Dept. of Zoology.
S. C. Mozley, and M. G. Butler.
Arctic, Vol. 31, No. 3, p 229-241, 1978. 1 fig, 2 tab, 18 ref.

Descriptors: *Oil, *Oil spill, Water pollution effects, *Arctic, *Aquatic insects, Bioassay, *Toxicity, Mortality, Canada, Ponds, Tundra, Tundra ponds, Chironimidae, Caddisflies, Stoneflies, On-site-investigation, Sampling.

Aquatic insects are numerous and important in the ecology of tundra thaw ponds, comprising most of the biomass and production. The most common types are the caddisflies Asynarchus and Micrasema, the stonefly Nemoura, the beetle Agabus and especially larvae of the fly family Chironomidae. Studies in vitro showed no detectable mortality of these insects at doses of oil up to 1,5 l/sq. m. Prudhoe Bay crude oil. However, field experiments on two ponds with application rates of about 10 l/sq. m. (Pond E. 1970) and 0.24 l/sq. m. (Pond Omega, 1975) both indicated that selective elimination of Asynarchus and Nemoura had occurred. Chironomidae in Pond Omega displayed much lower rates of adult emergence in 1976 and 1977 than in 1975, immediately before and after oil treatment, with several species in the tribe Tanytarsini most reduced. Pond E did not show low emergence rates, but the proportion of Orthocladiinae was much higher than in reference ponds. Trichotanypus was severely reduced in Pond Omega but unusually abundant in Pond E in 1976 and 1977. Effects of oil seem to be different for different species, and occur at some point during the late larval stages of insects or at metamorphosis, but toxicity experiments did not confirm this. Oil may also interfere with reproduction in insect species which remain mainly on or near the pond surface as adults. (Katz-EIS)
W79-08462

AN ATTEMPT TO COMBINE A BIOLOGICAL PURIFICATION OF MUNICIPAL SEWAGES WITH THEIR UTILIZATION IN FISHERIES, (IN POLISH),
Instytut Oceanografii Rybackieg, Szczcin (Poland).
L. Szlauer, and B. Szlauer.
Zeszyty Naukowe Akademii Rolniczej W Szczecinie, No. 70, p 73-83, 1978. 2 fig, 2 tab, 12 ref. (English Summary).

Descriptors: *Carp, *Daphnia, *Aquiculture, Zooplankton, Freshwater fish, Nutrients, Waste treatment, *Sewage disposal, Sewage effluent, Sewage treatment, Fish diets, Fish production, Fish harvest, Phytoplankton, Phosphates, Ammonium compounds.

A final treatment of municipal wastes of the town of Nowogard was attempted through their utilization in zooplankton and juvenile carp cultures. The culturing was carried out under laboratory conditions as well as in the open air in tanks and 1000-l ponds. In summertime, the sewage altered its original properties so that phytoplankton and Daphnia magna could live in it as early as after 10 days of retention in ponds, while after 20 days juvenile carp were able to dwell there. A mean production of D. magna kept in the sewage was 10.8 mg/l/day, which, when converted to a 1 hectare area of a 1-m deep pond gives 15.4 t possible to obtain over 5 warm months. The juvenile carp production obtained from a 1 ha and 1m deep pond after 100 days was 957 and 1450 kg. The latter figure concerns a culture in which juvenile fish were fed with zooplankton caught in another sewage pond. Reductions in nutrient contents amounting, on the average, to 74.7% phosphate, 94.2% ammonium, and 96.5% oxidation potential was found to occur in all the ponds. (Katz-EIS)
W79-08463

FINAL PURIFICATION OF EFFLUENTS FROM MINERAL FERTILIZERS PLANT IN EXPERIMENTAL PONDS DURING WINTER, (IN POLISH),
Instytut Oceanografii Rybackieg, Szczcin (Poland).
B. Szlauer, and L. Szlauer.
Zeszyty Nawkowe Akademii Rolniczej W Szczecinie, No. 70, p 85-102, 1978. 6 tab, 10 ref. (English Summary).

Descriptors: *Nutrients, *Carp, *Daphnia, *Waste treatment, Freshwater fish, Poland, Fertilizer plant, Ponds, Reproduction, Growth rates, On-site-investigations, Industrial wastes, Zooplankton, Biomass, Water pollution effects, Aquiculture.

In the winter months of the years 1974-1977, an attempt was being made to purify in experimental ponds the effluents released by the Police Chemical Plant and, at the same time, to test a possibility of keeping zooplankton and juvenile carp under those conditions. The attempt proved successful. A concentrated sewage obtained directly from the chemical treatment plant as well as the sewage enriched with nitrogen compounds enabled phytoplankton and zooplankters, large species of Daphnia magna and D. pulex included, to develop in winter. Those cladocerans reproduced in winter, as did other zooplankters, their abundance being, however, about 10 times lower than in summer. 66.7% of juvenile carp kept in winter in the sewage survived, a mean individual weight increment reaching almost 100%; from 5.85 to 10.9 g. The planktonic organisms and carp survival in winter in the sewage ponds was made possibly by a fairly good oxygenation maintained in the ponds, particularly under ice. Those favorable conditions were occurring due to low quantities of decaying organic remains and due to a winter growth of oxygen-producing algae. A biological purification of sewage left in ponds from October through April was found to have occurred. The N-NH4+ and PO43- reductions were 0.97 and 0.07 mg/l/day, respectively. (Katz-EIS)
W79-08464

SAFE ZINC AND COPPER LEVELS FROM THE SPRING CREEK STEELHEAD TROUT IN THE UPPER SACRAMENTO RIVER, CALIFORNIA,
California State Dept. of Fish and Game, Rancho Cordova. Water Pollution Control Lab.
G. J. Finlayson, and S. H. Ashuckian.
California Fish and Game, Vol. 65, No. 2, p 80-99, 1979. 2 fig, 6 tab, 27 ref.

Descriptors: *Zinc, *Copper, Metals, *Aluminum, *Iron, Toxicity, Methodology, Laboratory tests, Rainbow trout, California, *Sacramento River, Spring Creek Diversion Dam, Shasta Lake, Mining acid water, Acid mine wastes, Fish eggs, Fish reproduction, Juvenile fish, Juvenile growth stage, Methodology, Bioassay, Water pollution effects, Water quality.

Acid mine discharges in the Spring Creek drainage, collecting behind the Spring Creek Diversion Dam, contribute large quantities of toxic zinc and coppr to the upper Sacramento River. The bioassays indicated that eggs were more resistant than alevins and fry to solutions containing both zinc and copper while solutions containing only zinc affected all stages equally. At the lower copper-to-zinc waste ratio of 1:12, copper was absent in solution at partially toxic levels and toxicity was attributable to zinc alone, while at the higher waste ratio of 1:4, copper was present in sufficient quantities to increase the toxicity of the waste. The incipient lethal levels (10% mortality) for the period from eggs-to-fry were. .12 mg/l Zn at the lower waste ratio, and .10 mg/l Zn and 0.11 mg/l Cu at the higher waste ratio. The incipient lethal level of control fry, those which had not been previously exposed to the waste, was .03 mg/l Zn. The presence of aluminum and iron in the waste apparently did not affect the toxicity of either zinc or copper. 'Safe' levels of zinc and copper for steelhead trout are below .03 mg/l and .01 mg/l, respectively. (Katz-EIS)
W79-08465

THE EFFECTS OF OIL SPILLS ON PHYTOPLANKTON IN AN ARCTIC LAKE AND PONDS,
Cincinnati Univ., OH. Dept. of Biological Sciences.
M. C. Miller, V. Alexander, and R. J. Barsdate.
Arctic, Vol. 31, No. 3, p 192-218, 1978. 14 fig, 4 tab, 27 ref.

Descriptors: *Oil spills, Water pollution effects, Lakes, Ponds, Freshwater, *Arctic, Alaska, Barrow, Alaska, Algae, *Phytoplankton, *Crude oil, *Natural oil seeps, On-site-investigation, Zooplankton, Photosynthesis, Biomass, Plant populations, Bioassay, Laboratory tests.

The effect of oil spilled on Alaskan freshwater phytoplankton populations was studied in waters affected by natural oil seeps, by controlled crude oil spills in tundra thaw ponds and in a morainal lake, by subpond manipulations and bioassay experiments. The studies were carried out over a period of seven years. Regardless of dose the effects of oil were predictable in the small ponds. The zooplankton populations were virtually eliminated, and after an initial depression of primary productivity the photosynthetic rates returned to approximately prespill levels with a small increase in algal biomass. A markedly altered algal composition was an invariable effect of the response, with the elimination of a dominant flagellated form, Rhodomonas spp., in the case of the ponds. From the results of subpond manipulation experiments, evidence supports the hypothesis that elimination of grazers is the principal cause of altered species composition and increased biomass in these ponds. In out lake system there was a severe reduction in primary production during the season of the experimental spill. During the second year only the spring boom was supressed by the added oil. Bioassay experiments supported the hypothesis that in such lakes, direct inhibition of algal photosynthesis may be important, although zooplankton were greatly reduced. (Katz-EIS)
W79-08466

MICROBIOLOGICAL CYCLING OF OIL IN ESTUARINE MARSHLANDS,
Georgia State Univ., Atlanta.
D. G. Ahearn, S. A. Crow, N. H. Berner, and S. P. Meyers.
In: Estuarine Processes, Volume I, Uses, Stresses and Adaptation to the Estuary, M. Wiley, editor, Academic Press, New York, N. Y., 1976, p 483-492. 1 fig, 6 tab, 13 ref.

Descriptors: *Oil, *Microorganisms, *Marshes, Oil spills, Bacteria, Yeasts, Sediments, Wetlands, Rooted aquatic plants, Cellulose, Decomposing organic matter.

Indigenous microflora of sediments of Spartina marshes of the Louisiana coast include a high percentage of celluloytic bacteria and ascosporogenous yeasts (Pichia and Kluyveromyces). At sites either accidentally or experimentally inundated with crude oil, the proportion of hydrcarbon-utilizing bacteria and yeasts increased. The marsh sediments contained low populations of hydrocarbonoclastic fungi with few strains showing significant oil-emulsifying properties. In culture, representative microorganisms readily utilized alkanes from C12 to C18. Oil utilization by a representative bacterium increased significantly as incubation temperatures were raised from 10 to 30 C, whereas yeasts showed peak activity at 20 C. Oil utilization by test microorganisms was negligible at 5 C. Seeding of experimentally oiled marsh plots with a mixed culture of Candida maltosa and C. lipolytica demonstrated that these species survived in the oiled area without spreading to adjacent sites. In culture these strains gave significant emulsification of crude oil and utilized up to 90% of selected hydrocarbons. (Stihler-Mass)
W79-08474

5D. Waste Treatment Processes

A MIXING MODEL FOR A SEPARATED MECHANICAL AERATION SYSTEM,
New Jersey Dept. of Environmental Protection, Trenton. Div. of Water Resources.
S-F. Hsueh, and R. C. Ahlert.
Water Resources Bulletin, Vol. 14, No. 6, p 1404-1416, December 1978. 6 fig, 2 tab, 16 ref.

Descriptors: *Input-output analysis, *Mixing, *Waste water treatment, *Aeration, Networks, Equations, Treatment facilities, Computers, Water quality, Activated sludge, Prediction, First-order reaction, Mathematical models, Systems analysis.

An input-output method, using a network of ideal continuous stirred-tank and plug-flow tubular reactors, is adopted to analyze residence time distribution data for a separated mechanical aeration system. The usefulness of this modeling concept is enhanced by its simplicity, especially in the presence of a first-order reaction. This facilitates use of the model format for wastewater quality prediction. Moreover, first-order rate constants can also be estimated from the model, if conversions due to the reaction rate are available. (Bell Graf-Cornell)
W79-08005

REAL-TIME CONTROL OF ACTIVATED SLUDGE PROCESS,
California Univ., Los Angeles. Dept. of Engineering Systems.
M. K. Stenstrom, and J. F. Andrews.
Journal of the Environmental Engineering Division, Proceedings of the American Society of Civil Engineers, Vol. 105, No. EE2, p 245-260, April 1979. 12 fig, 1 tab, 40 ref.

Descriptors: *Activated sludge process, *Simulation analysis, *Computers, *Mathematical models, Waste water treatment, Oxygen demand, Control, Environmental engineering, Sanitary engineering, Systems analysis, Equations.

A technique for real-time control of the activated sludge process using specific oxygen uptake rate (SCOUR) has been developed. Mathematical modeling and computer simulation techniques were used to develop multivariant control strategies using SCOUR and mean cell retention time as the controlled variables, and manipulating sludge recycle rate, sludge wasting rate, and wastewater feed point location. It is shown that SCOUR is a valid indicator of process efficiency and sludge activity for nonsteady state operation and that multivariant control techniques using SCOUR are superior to techniques that use only food-to-mass ratio, for mean cell retention time. It is also shown that SCOUR can be used to defect shock loads of toxic and biodegradable materials. The value of forecasting flow rates for improving control is illustrated through the use of time-series models. (Bell Graf-Cornell)
W79-08009

TOXIC SUBSTANCES IN THE EFFLUENTS OF PETROCHEMICAL PLANTS AND THEIR EFFECT ON AQUATIC ORGANISMS (REVIEW),
Irkutskii Gosudarstvennyi Univ. (USSR). Scientific Research Inst. of Biology.
For primary bibliographic entry see Field 5B.
W79-08045

THE ACCUMULATION OF HEAVY METALS IN THE SUBMERGED PLANT (ELODEA NUTTALLII),
Kanagawa Prefectural Environmental Control Center, Yokohama (Japan).
For primary bibliographic entry see Field 5B.
W79-08051

RAPID APPRAISAL OF THE EFFECTS OF VARIOUS SUBSTANCES ON MICROORGANISMS,
Institut National de Recherche Chimique Appliquee, Vert-le-Petit (France).
For primary bibliographic entry see Field 5B.
W79-08071

THE ROLE OF PLANT RESIDUES IN THE RETENTION OF CADMIUM IN ECOSYSTEMS,
Delaware Univ., Newark. School of Life and Health Sciences.
G. F. Somers.
Environmental Pollution, Vol. 17, p 287-295, 1978. 6 tab, 13 ref. OWRT A-038-DEL (2).

Descriptors: *Plant tissues, *Cadmium, *Adsorption, *Pollution abatement, *Water pollution control, Laboratory tests, Cation adsorption, Chemical analysis, Water pollution treatment, Deciduous trees, Decomposing organic matter.

The possible ecological role of plant residues in absorbing and retaining cadmium (Cd)++ following an environmental insult was investigated. Fresh and partially decomposed plant material was collected from an old uncultivated field, from the ground of a deciduous woodland, and from under various species of pine trees. The material was dried, finely ground, suspended in Cd (NO3)2 with added tracer amounts of 109 Cd, filtered, and counted. Total counts for all fractions were about 80,000. It was found that 70 to 85% of the total Cd was adsorbed at the lowest concentration of Cd (NO3)2, and about 30 to 40% was adsorbed at the highest concentration. The Klotz (1953) theory of multiple equilibria was modified and used to evaluate the exchange parameters of Cd++. The total number of cadmium-binding sites (n) and the intrinsic association constant (k) were determined. Changes occurring in the magnitude of n with litter decomposition seemed to be associated with changes in cellulose and lignin content. Although the specific components of the litter responsible for Cd++ adsorption have not been identified, it is concluded that the materials tested all have a significant capacity to bind this cation. It is speculated that since this material covers areas from which water supplies are drawn, it could provide a safeguard against surges of Cd++ pollution. (Davison-IPA)
W79-08163

SOUTHEASTERN MICHIGAN (SEM) WASTEWATER MANAGEMENT SURVEY SCOPE STUDY, EVALUATION APPENDIX.
Army Engineer District, Detroit, MI.
For primary bibliographic entry see Field 6B.
W79-08171

REUSE OF MUNICIPAL WASTEWATER AND DEVELOPMENT OF NEW TECHNOLOGY--EMPHASIS AND DIRECTION NEEDED.
Comptroller General of the United States, Washington, DC.
Report No. CED-78-177, November 13, 1978. 43 p.

Descriptors: *Water quality, *Water quality standards, *Wastewater, *Water reuse(Reclaimed water), *Waste water disposal, *Water pollution control, *Land application, Water pollution treatment, Waste water treatment, Water supply, Advanced waste treatment, Secondary treatment, Technology, Biological oxygen demand, Sludge, Federal Water Pollution Control Act, Construction grant programs.

This is a review of the apparent absence of new and innovative technologies in waste treatment projects being constructed under the Environmental Protection Agency's (EPA) construction grants program. It concentrates on the greater use of land application of wastewater and wastewater reuse and suggests ways of overcoming any obstacles which inhibit the use of these two approaches. The report describes the goals and requirements of the Federal Water Pollution Control Act of 1972, the Act's emphasis on land application and recycling and EPA's construction grant program. Conventional technology was defined as systems which have been widely used for at least 20 years to treat municipal wastewater or sludge. Any other technology or modification was classified as new, as long as it would be available for online use within ten years. A chart listing all known, new technologies and number of times used in the construction grant program is presented with an analysis of obstacles contributing to limited use of new technology. This limited use results from the fact that some new technologies provide an unnecessarily high level of treatment or are not cost effective compared to conventional technologies. The report also describes the major land application techniques--slow rate, rapid infiltration, and overland flow--and concludes that obstacles to its further use are: (1) stringent state pretreatment requirements render it too costly; (2) absence of technical and demonstration information restricts the thorough evaluation of land treatment systems; (3) limited information on health effects exists; and (4) lack of suitable land. The report offers several recommendations to overcome these obstacles. (Coan-NC)
W79-08183

METHOD FOR DECONTAMINATING WASTE MATERIAL FROM CHROMIUM MINERAL PROCESSING BY WET TREATMENT WITH SULPHUR,
Stappani (Luigi) di Stappani (P.) and Co., Milan (Italy). (Assignee).
G. Ghelli.
U.S. Patent No. 4,139,460, 7 p, 1 fig, 5 ref; Official Gazette of the United States Patent Office, Vol. 979, No. 2, p 643, February 13, 1979.

Descriptors: *Patents, *Industrial wastes, *Pollution abatement, Chromium, Water reuse, Alkaline earth metals, Sulfur, Recycling, Chromium mineral processing.

A method is described for decontaminating waste materials. The residue of water leaching of the roasted chromium mineral containing water soluble hexavalent chromium compounds is wet ground and classified until obtaining such a granulometrical distribution that not more than 5-10% of the particles have an average size larger than 0.4 mm, and 40-60% of the particles have an average size less than 0.8 mm, and is then subjected to wet treatment under vigorous stirring at about 100 degrees C with sulphur, in an aqueous emulsion of alkaline or alkaline-earth sulphide for 1-4 hours, the percentage of solids in the reactor being in the range of 1-60%, preferably 30-35% by weight. The reacted slurry is thickened and filtered to provide the restored or decontaminated earth and an effluent, which is partly recycled to grinding or to reaction. (Sinha-OEIS)
W79-08214

METHOD OF AND APPARATUS FOR PURIFYING WASTE WATER,
Agrotechnika Narodny Podnik, Zvolen (Czechoslovakia). (Assignee).
S. Mackrle, V. Mackrle, and O. Dracka.
U.S. Patent No. 4,139,457, 9 p, 6 fig, 10 ref; Official Gazette of the United States Patent Office, Vol. 979, No. 2, p 642, February 13, 1979.

Descriptors: *Patents, *Waste water treatment, *Water pollution treatment, Water purification, Separation techniques, Filtration, Turbulence, Suspended solids, Flow, Equipment.

An improved technique for reprocessing, through a reaction zone, a portion of an agitated flow of waste water that is coupled into a wedge-shaped or frusto-conical separating zone via such reaction zone is described. A recirculation conduit, independent of an inlet aperture at the bottom of the separating zone for admiting an upward flow of water, has an inlet end is connected to the upper part of the separating zone. The outlet of the recirculation zone empties into the agitated water stream in the reaction zone. The inlet aperture at the bottom of the separating zone has a cross-sectional area which is small relative to the cross-sectional area of the separating zone and small relative to the cross-sectional area of the reaction zone. The resulting pressure drop between the inlet aperture at the bottom of the separating zone and the outlet of the recirculation conduit prevents impurities in the separation zone from returning to the reaction zone through the inlet opening. (Sinha-OEIS)
W79-08215

PROCESS FOR OXIDATION TREATMENT OF FE2+ IN WASTE WATER,
Dowa Mining Co., Ltd., Tokyo (Japan). (Assignee).
E. Yabuuchi, and K. Fukuda.
U.S. Patent No. 4,139,456, 9 p, 4 fig, 4 tab, 14 ref; Official Gazette of the United States Patent Office, Vol. 979, No. 2, p 642, February 13, 1979.

Descriptors: *Patents, *Waste water treatment, *Water pollution treatment, Acid mine water, Acidic water, Industrial wastes, Iron bacteria, Oxidation, Diatomaceous earth.

Improved process for the oxidation of the Fe2+ in waste water is disclosed. The process if especially advantageous when applied to low pH acidic waste waters containing substantial amounts of the Fe2+ and is carried out by making use of acid-proof, porous material as a bed-material for iron bacteria to inhabit. The bed-material is suspended in the waste water to be treated and is used repeatedly in a closed circuit. An acid-resistant, porous and particulate material as used in this invention means any porous material with a surface area great enough for a large number of iron bacteria to inhabit it, and possesses the properties of readily flowing when agitated and of immediately precipitating with or without addition of coagulant when allowed to stand. It was found that F-type diatomaceous earth is especially effective. (Sinha-OEIS)
W79-08216

APPARATUS FOR REMOVING DEBRIS DURING SEWAGE TREATMENT,
A. Bologna.
U.S. Patent No. 4,138,343, 6 p, 5 fig, 15 ref; Official Gazette of the United States Patent Office, Vol. 979, No. 1, p 265, February 6, 1979.

Descriptors: *Patents, *Waste water treatment, *Sewage treatment, *Water pollution treatment, Equipment, Separation techniques, Floating debris, Endless conveyors, Rakes.

A rake-like structure is suspended near the surface of circulating liquid sewage in an open-top treatment tank to snare and retain rags and similar debris, enabling periodic removal and separate disposal of the debris. This prevents contaminated flow in valves and passages of the treating system and assures a relatively clean liquid sludge as a product of the treatment process for use as fertilizer on open land. An endless conveyor arrangement is provided to automatically pick up collected debris from a modified form of the rake-like structure and transport it to a location outside the treatment tank. (Sinha-OEIS)
W79-08219

SEWAGE AERATING STRUCTURE,
Atara Corp., Montreal (Quebec). (Assignee).
D. S. Murphy.
U.S. Patent No. 4,138,335, 7 p, 5 fig, 9 ref; Official Gazette of the United States Patent Office, Vol. 979, No. 1, p 262-263, February 6, 1979.

Descriptors: *Patents, *Waste water treatment, *Sewage treatment, Water pollution treatment, Aeration, Bubbles, Equipment, Mixing, Impact plate.

Aeration and mixing efficiency of sewage can be increased dramatically by causing the gas-entrained sewage to collide with an impact plate, so that not only frictional shearing of the bubbles will occur, but what appears to be shattering, as well. The result is substantially more finely divided air bubbles, greatly increased in number, and therefore greater surface area which has been found to substantially increase the aeration efficiency. The effect depends on a particular relationship of distance of the impact plate from a position of maximum velocity of fluid flow of the sewage. The impact plate can be shaped in such manner as to cause movement of the sewage after impact downwardly and to the side, so that the bubbles do not immediately rise to the surface of the pond, and remain entrained for longer periods. The aerating structure comprises a flue for conducting gas entrained fluids vertically toward the top of a pond, and an impact plate fixed over the exit of the flue. The flue takes the shape of a funnel, the impact plate being spaces a specific distance from the narrowest end of the funnel. (Sinha-OEIS)
W79-08223

METHOD OF TREATING WASTE WATER OF A NUCLEAR POWER PLANT AND A SYSTEM THEREFOR,
Hitachi, Ltd. (Japan). (Assignee).
N. Kita.
U.S. Patent No. 4,138,329, 7 p, 2 fig, 3 ref; Official Gazette of the United States Patent Office, Vol. 979, No. 1, p 260, February 6, 1979.

Descriptors: *Patents, *Waste water treatment, *Industrial water, *Nuclear powerplants, Nuclear wastes, Radioactive wastes, Ion exchange, Recirculated water, Water reuse.

In a steam turbine system of a nuclear power plant which forms a closed loop, the waste water contaminated with radioactive impurities is decontaminated by means of ion exchange and heated to produce steam which is used as steam for providing a seal to the gland seal sections of the steam turbine. The steam is condensed back into water which is recirculated through the heating process. (Sinha-OEIS)
W79-08224

USE OF A HIGH CAPACITY AERATION COMPARTMENT IN A MULTIPLE AERATION SYSTEM,
E. Schnitzler.
U.S. Patent No. 4,138,328, 6 p, 1 fig, 13 ref; Official Gazette of the United States Patent Office, Vol. 979, No. 1, p 260, February 6, 1979.

Descriptors: *Patents, *Waste water treatment, *Sewage treatment, Water purification, Activated sludge, Aeration, Equipment, Buffer vessel.

An apparatus for the purification of waste water with the activated-sludge process, comprises a buffer vessel downstream of a settling tank with a mechanical cleaner; at least one oxidation trough or vessel provided with at least one aerating device and a device for subdividing the input into the latter receptacle in the region of the aeration device; an afterclarifying receptacle; and a sludge recycling path from the afterclarifier. The buffer vessel is also provided with an aeration device and the waste water or sewage is treated there to partially reduce its biological oxygen demand. Between the buffer vessel and the oxidation receptacle, a high-efficiency stage is provided which is formed with an aeration device. The sludge recycle from the afterclarifier is introduced into the high-efficiency receptacle which is provided in the region of the aeration device of the latter with a distributor for the recycled sludge and a distributor for the discharge from the buffer vessel. (Sinha-OEIS)
W79-08225

METHOD AND APPARATUS FOR CONTINUOUSLY WASHING FIBROUS SUSPENSIONS AND CONTROLLING THE VOLUME OF WASH LIQUID,
Mo Och Domsjo A. B., Ornskoldsvik (Sweden). (Assignee).
P. A. R. Hillstrom, and L. G. Norehall.
U.S. Patent No. 4,138,313, 12 p, 1 fig, 6 tab, 8 ref; Official Gazette of the United States Patent Office, Vol. 979, No. 1, p 255, February 6, 1979.

Descriptors: *Patents, *Waste water treatment, *Pulp wastes, Pulp and paper industry, Cellulose, Fibers(Plant), Equipment, Washing process.

Cellulose pulp is washed after separation of the pulping liquor at the conclusion of the digestion, before it is passed on the subsequent chemical treatment stages, such as bleaching. Dissolved impurities present in the pulping liquid after digestion include the pulping chemicals and the organic substances formed in the course of the pulping process which are water-soluble and become dissolved in the liquor. The cellulose pulp washing system is designed to remove the dissolved impurities by replacing the aqueous suspending liquor with a fresh or relatively pure aqueous suspending liquid, substantially free from such impurities, or at least having a lower content of impurities. In a continuous washing operation it is necessary to measure: (1) the volumetric flow rate of the washed suspension; (2) the liquid content of the washed suspension; and (3) the content of dissolved impurities in the suspending liquid. Then the volume amount of wash liquid added is controlled according to the washing losses to maintain washing losses within a predetermined limiting range. (Sinha-OEIS)
W79-08226

ROTATING BIOLOGICAL CONTACTOR,
FMC Corp., Chicago, IL. (Assignee).
F. F. Sako, and C. C. Pearson.
U.S. Patent No. 4,137,172, 6 p, 8 fig, 3 ref; Official Gazette of the United States Patent Office, Vol. 978, No. 5, p 1772, January 30, 1979.

Descriptors: *Patents, *Waste water treatment, *Sewage treatment, Biological treatment, Equipment, Slime, Aeration, Aerobic conditions.

An apparatus for treating sewage provides uniquely designed thin discs that are mounted on a shaft so that the discs are immersed approximately 40% in a sewage tank. The shaft is rotated at peripheral speeds on the order of 35-75 feet per minute to alternately expose the discs to the atmosphere and the liquid wastewater in the tank providing for the growth of biological slimes on the surfaces of the discs. The discs have a corrugated configuration with the corrugations of the alternate discs disposed at ninety degrees to each other to provide maximum usable surface area in a given rotating volume while having sufficient clearance to permit unobstructive sloughing of growths. (Sinha-OEIS)
W79-08231

SEWAGE TREATMENT UNIT,
D. Foti.
U.S. Patent No. 4,139,471, 6 p, 3 fig, 7 ref; Official Gazette of the United States Patent Office, Vol. 979, No. 2, p 648, February 13, 1979.

Descriptors: *Patents, *Waste water treatment, *Sewage treatment, Domestic wastes, Septic tanks, Biological treatment, Aerobic bacteria, Anaerobic bacteria, Equipment.

An apparatus transforms raw sewage into a substantially colorless and odor free effluent by the alternate action of aerobic and anaerobic bacteria as the sewage flows through a primary chamber and a secondary chamber to a settling chamber and finally to a holding tank from which the effluent discharges to a disposal area. The simple mechanical structure can be fabricated from fiberglass. (Sinha-OEIS)
W79-08233

RELEASE OF TRACE METALS BY SEWAGE SLUDGE AND THE SUBSEQUENT UPTAKE BY MEMBERS OF A TURTLE GRASS MANGROVE ECOSYSTEM,
Harbor Branch Foundation, Inc. Fort Pierce, FL.
For primary bibliographic entry see Field 5A.
W79-08296

DEGRADATION OF DIAZINON BY SODIUM HYPOCHLORITE. CHEMISTRY AND AQUATIC TOXICITY,
Army Medical Bioengineering Research and Development Lab. Fort Detrick, MD.
For primary bibliographic entry see Field 5A.
W79-08298

TILAPIA PRODUCTION IN PONDS RECEIVING SWINE WASTES,
Texas A and M Univ., College Station. Dept. of Wildlife and Fisheries Sciences.
For primary bibliographic entry see Field 5E.
W79-08302

ALGAE-SWINE MANURE SYSTEM FOR PRODUCTION OF SILVER CARP, BIGHEAD CARP, AND TILAPIA,
Tennessee Valley Authority, Muscle Shoals, AL.
For primary bibliographic entry see Field 5C.
W79-08303

AN EVALUATION OF THE FILTER FEEDING FISHES, SILVER AND BIGHEAD CARP, FOR WATER QUALITY IMPROVEMENT,
Arkansas Game and Fish Commission, Little Rock.
For primary bibliographic entry see Field 5C.
W79-08304

POLYCULTURE OF CHINESE CARPS IN PONDS WITH SWINE WASTES,
Illinois Natural History Survey, Kinmundy.
For primary bibliographic entry see Field 5C.
W79-08305

OVERLAND RECYCLING SYSTEM FOR ANIMAL WASTE TREATMENT,
Alcorn State Univ., Lorman, MS. Dept. of Animal Science.
H. E. Grier, and W. C. Burton.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-293 156, Price codes: A05 in paper copy, A01 in microfiche. Final Report No. EPA-600/2-79-029, January 1979. 82 p, 14 fig, 43 tab, 37 ref, 1 append. R-802336.

Descriptors: *Domestic animals, *Hogs, *Waste treatment, *Fertilizers, *Crop response, Effluents, Lagoons, Aerobic treatment, Biodegradation, Soil water, Soil chemistry, Soil profiles, Nitrogen, Nitrites, Nitrates, Soil properties.

The technical and economic feasibility of an alternate disposal and utilization system of animal waste management was evaluated to define techniques for deriving nutrient benefits from animal wastes and making them directly available for selected crop production. Swine wastes were disposed of in two lagoons, one anaerobic and the other aerobic, and then pumped through an overland spray system to irrigate three demonstration fields and 12 research plots. Growth responses of the animal forages grown in the demonstration fields and the vegetables grown in the research plots were assessed. Baseline data was established for soil contents and depths during the pre-application period. After each of three trial periods soil water was chemically analyzed for pH, chloride, specific conductance, nitrate, nitrite, and ammonia nitrogen. The impact of these parameters on the soil-plant-soil water system was evaluated. The results indicated that acidity in soil water was higher after the trials than in pretreatment soil analysis, because hydrogen ions were attached to clay particles in the soil and were free in soil water. Nitrogen removal from the soil increased as the application rate of nitrogen increased. Where limited nitrogen removal from the soil occurred there was very little ion removal when certain types of plants were harvested. (Davison-IPA)
W79-08354

REDUCTION OF HALOFORMS IN DRINKING WATER SUPPLIES,
Ontario Ministry of the Environment, Ottawa.
M. C. Fung.
Report No. 69. September 1978. 66 p, 12 fig, 12 tab, 21 ref, 2 append.

Descriptors: *Halogens, *Chlorine, *Coagulation, *Sedimentation, *Chlorination, Activated carbon, Chloroform, Silica, Alum, Water treatment, Potable water, Humber River, Belleville(Ontario Canada), Brantford(Ontario Canada), Cayuga(Ontario Canada), Haloforms, Organic compounds.

Two bench-scale experiments on water from Belleville, Brantford, Cayuga, and the Humber River in Ontario were conducted to determine the minimum modifications to present water treatment processes that can reduce haloform formation. Haloform precursors (post-chlorination) and haloforms (pre-chlorination) were removed using three techniques: coagulation using various types of coagulant chemicals, adsorption on granular activated carbon (GAC), and use of powered activated carbon (PAC). Haloform precursors were reduced up to 92% during a process utilizing alum coagulation with activated silica and post-chlorination. Up to 90% removal was obtained from GAC; absorption PAC was not effective as a reducer. For minimized haloform formation, alum coagulation/sedimentation should precede chlorination. Ozone, potassium permanganate, and hydrogen peroxide were studied as alternatives to chlorine in the pretreatment process; the resulting phenomena are not well understood. Overall performance of alum coagulation with activated silica in reducing the chlo-

roform precursors was unaffected by the disinfectants; disinfection efficiency, residual effects on growths in the filters, and taste and odor removal were not studied. Toxicity studies of the byproducts is suggested. (Schaefer-IPA)
W79-08355

THE CLEAN WATER ACT OF 1977,
For primary bibliographic entry see Field 6E.
W79-08413

MERCURY IN HERONS, EGRETS, AND THEIR FOODS,
Ohio Cooperative Wildlife Research Unit, Columbus.
For primary bibliographic entry see Field 5C.
W79-08457

ASSIMILATION OF SEWAGE BY WETLANDS,
Marine Biological Lab., Woods Hole, MA. Boston Univ. Marine Program.
I. Valiela, S. Vince, and J. M. Teal.
In: Estuarine Processes, Volume I, Uses, Stresses, and Adaptation to the Estuary, M. Wiley, editor, Academic Press, New York, N.Y., 1976, p 234-253. 5 fig, 3 tab, 88 ref.

Descriptors: *Wetlands, *Sewage treatment, *Biological treatment, Marshes, Nitrogen, Phosphorus, Metals, Lead, Zinc, Cadmium, Muds, Soils, Pesticides, Pollutants, Biomass, Rooted aquatic plants, Microorganisms, Waste water.

The effluent-properties of a variety of wetland habitats in very diverse parts of the world (salt and brackish marshes, polders, cypress, papyrus and mangrove swamps, freshwater marshes and bogs) have been studied. Although each habitat type differs, current results from marshes show that nitrogenous and phosphorus nutrients are removed from contaminated or waste waters. Heavy metals from sludges are retained by marsh muds, but the effectiveness varies considerably for different metals. Petroleum hydrocarbons accumulate in marsh muds and may be actively decomposed, particularly at lower levels of contamination. Chlorinated hydrocarbons have high affinities for marsh sediments and can be altered by microorganismal activity. There is preliminary evidence that counts of coliform bacteria may be reduced in tidal water that floods marshes. The waste-processing ability of coastal wetlands must have an upper threshold. Little is known about these upper limits but studies in chronically contaminated sites show that marshlands function well even in severly polluted areas. (Stihler-Mass)
W79-08471

5E. Ultimate Disposal Of Wastes

STRUCTURE RELATED UPTAKE OF CHLORINATED PARAFFINS IN BLEAKS (ALBURNUS ALBURNUS L),
National Swedish Environment Protection Board, Studsvik (Sweden). Brackish Water Toxicology Lab.
For primary bibliographic entry see Field 5A.
W79-08073

EFFECTS OF SUSPENDED SEDIMENTS ON PHOTOLYSIS RATES OF DISSOLVED POLLUTANTS,
Environmental Research Lab., Athens, GA.
For primary bibliographic entry see Field 5B.
W79-08080

SOUTHEASTERN MICHIGAN (SEM) WASTEWATER MANAGEMENT SURVEY SCOPE STUDY, EVALUATION APPENDIX.
Army Engineer District, Detroit, MI.
For primary bibliographic entry see Field 6B.
W79-08171

TILAPIA PRODUCTION IN PONDS RECEIVING SWINE WASTES,
Texas A and M Univ., College Station. Dept. of Wildlife and Fisheries Sciences.
R. R. Stickney, and J. H. Hesby.
In: Culture of Exotic Fishes Symposium Proceedings p 90-96, 1978. 33 ref. R. O. Smitherman, W. L. Shelton, J. H. Grover, eds, Fish Culture Section, American Fisheries Society, Auburn, Alabama.

Descriptors: *Tilapia, *Fish farming, *Hogs, *Fish diets, Domestic animals, Domestic wastes, Waste disposal, Recycling, Poultry, Fish populations, Growth rates, Nutrients, Sewage lagoons, Water quality, Oxidation lagoons.

The emphasis of aquacultural research on tilapia in Texas has been focused on Tilapia aurea. Preliminary investigations have been conducted to determine the protein requirements of this species, with most of the research centered on the production of T. aurea in ponds receiving swine and poultry wastes. The tolerance of T. aurea to poor water quality allows this species to survive under conditions which might be lethal to more traditional United States aquaculture fishes. Rapid growth will occur in T. aurea reared in ponds receiving input directly from swine or from primary settling ponds. Fish produced in waste lagoons can be utilized as human food or to supplement the diets of livestock. (Deal-EIS)
W79-08302

ALGAE-SWINE MANURE SYSTEM FOR PRODUCTION OF SILVER CARP, BIGHEAD CARP, AND TILAPIA,
Tennessee Valley Authority, Muscle Shoals, AL.
For primary bibliographic entry see Field 5C.
W79-08303

AN EVALUATION OF THE FILTER FEEDING FISHES, SILVER AND BIGHEAD CARP, FOR WATER QUALITY IMPROVEMENT,
Arkansas Game and Fish Commission, Little Rock.
For primary bibliographic entry see Field 5C.
W79-08304

POLYCULTURE OF CHINESE CARPS IN PONDS WITH SWINE WASTES,
Illinois Natural History Survey, Kinmundy.
For primary bibliographic entry see Field 5C.
W79-08305

THE CLEAN WATER ACT OF 1977: MIDCOURSE CORRECTIONS IN THE SECTION 404 PROGRAM,
For primary bibliographic entry see Field 6E.
W79-08421

5F. Water Treatment and Quality Alteration

REUSE OF MUNICIPAL WASTEWATER AND DEVELOPMENT OF NEW TECHNOLOGY--EMPHASIS AND DIRECTION NEEDED.
Comptroller General of the United States, Washington, DC.
For primary bibliographic entry see Field 5D.
W79-08183

WATER QUALITY STANDARDS, NAVIGABLE WATERS OF THE STATE OF MISSISSIPPI (FINAL RULE),
Environmental Protection Agency, Washington, DC.
For primary bibliographic entry see Field 6E.
W79-08424

GROWTH OF RAINBOW TROUT FED ON VARIOUS PORTIONS OF FOOD IN COOLING WATERS, (IN POLISH),
Instytut Akwakultury i Techniki Rybackiej, Szczecin (Poland).
For primary bibliographic entry see Field 5C.
W79-08461

AN ATTEMPT TO COMBINE A BIOLOGICAL PURIFICATION OF MUNICIPAL SEWAGES WITH THEIR UTILIZATION IN FISHERIES, (IN POLISH),
Instytut Oceanografii Rybackieg, Szczcin (Poland).
For primary bibliographic entry see Field 5C.
W79-08463

FINAL PURIFICATION OF EFFLUENTS FROM MINERAL FERTILIZERS PLANT IN EXPERIMENTAL PONDS DURING WINTER, (IN POLISH),
Instytut Oceanografii Rybackieg, Szczcin (Poland).
For primary bibliographic entry see Field 5C.
W79-08464

5G. Water Quality Control

MANAGEMENT OF BOTTOM SEDIMENTS CONTAINING TOXIC SUBSTANCES.
Corvallis Environmental Research Lab., OR.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-289 777, Price codes: A14 in paper copy, A01 in microfiche. Report No. EPA-600/3-78-084, September 1978. Proceedings of the Third U.S.-Japan Expert's Meeting, held in Easton, MD, November 15-17, 1977. 314 p, 78 fig, 91 tab, 140 ref.

Descriptors: *Sediments, *Bottom sediments, *Toxicity, Effluents, Water pollution control, Turbidity, Dredging, Mercury, Benthos, Hydrodynamics, Pesticide residues, Pesticide removal, Bioassay, Legal aspects, Toxic substance control act, The US-Japan Ministerial Agreement.

A compilation of papers presented at the Third U.S.-Japan Expert's Meeting held November 15 through 17, 1977 in Easton, Maryland, is provided. The topics covered in the eight Japanese papers include: control of toxic effluents and management of toxic bottom sediments; present and future water pollution control projects in Japanese rivers and lakes; turbidity generated by dredging projects; recent progress in techniques for managing contaminated bottom sediments; dredging toxic sediments in Yokkaichi Port; accumulation of methyl mercury in red sea bream via the food chain; the relationship between sediments and benthos in Mikawa Bay; and a hydrodynamic study of lake pollution. The nine U.S. papers covered the following topics: the Toxic Substance Control Act affects EPA research and enforcement; mitigation feasibility for the kepone-contaminated James River; Hudson River-PCB Study; bottom sediment problems in Saginaw River and Bay, Marinette-Menominee Harbor, and Waukegan Harbor; impacts of dredged discharge into open water; bioassay for the toxicity of sediment to the marine macrobenthos; eutrophication control; dredged material regulation guidelines and criteria; and densification, treatment, and management of dredge material disposal areas. (Davison-IPA)
W79-08157

THE MISSOURI BASIN REGION'S WATER QUALITY PLANNING STRATEGY PLANNING DOSSIER. SECOND EDITION.
Federal Water Quality Control Administration, Washington, DC.
For primary bibliographic entry see Field 5B.
W79-08174

METHOD OF AND MEANS FOR OILY WATER SEPARATION,
R. H. Murphy.
U.S. Patent No. 4,139,463, 14 p, 7 fig, 7 ref; Official Gazette of the United States Patent Office, Vol. 979, No. 2, p 644, February 13, 1979.

Descriptors: *Patents, *Oil pollution, *Water pollution treatment, *Oily water, Separation techniques, Flow control, Filtration, Equipment, Pumps, Bilge water, Gravity separation, Product recovery.

An oily water separator method and means uses a suction pump to withdraw oil and water from a ship's bilge or sump. To decrease emulsification of the mixture, the pump is positioned downstream of an initial filter and the separator. The pump draws the oil-water mixture by suction through a particulate filter and then into a separator. Fluid flow is slowed by the specially configured baffled separator to allow the majority of the inter-mixed oil to separate from the water by gravity before reaching the pump. The suction pump draws the water from the lower portion of the separator housing and pumps the now almost oil-free water through two additional filter stages. Means are included for reversing the pump direction to force accumulated oil floating on water from the separator housing to a holding tank. (Sinha-OEIS)
W79-08213

DEVICE FOR SEPARATING WATER FROM SUBSTANCES CONTAINED THEREIN,
Ballast-Nedam Groep N.V., Amstelveen (Netherlands; and Skimovex B. V., The Hague (Netherlands). (Assignees).
C. G. Middelbeek, T. A. Wolters, and J. B. Den Boer.
U.S. Patent No. 4,138,342, 8 p, 12 fig, 4 ref; Official Gazette of the United States Patent Office, Vol. 979, No. 1, p 265, February 6, 1979.

Descriptors: *Patents, *Water pollution treatment, *Water quality control, Separation techniques, Equipment, Gravity separation.

A device is described for separating water by means of gravity segregation from water insoluble substances contained therein. The device obtains a uniform distribution of the substances over parallel channels. Displacer means are arranged which increasingly restrict the flow of liquid into the channels in the segregation direction. The displacer means are a plurality of teeth divided over the width of the separation channels and mainly extending in the piling direction of the separation channels. The width of the teeth increases in the segregation direction. If the substances are lighter than water the tooth width will increase in an upward direction, whereas in the case of heavier substances the tooth width will increase in a downward direction. However, in case large particles of heavy substances as well as of light substances occur in the water, then teeth width are preferably increased in both segregation directions. (Sinha-OEIS)
W79-08220

ENDLESS BELT CONVEYOR FOR COLLECTING FLOATING MATTER FROM WATER SURFACE,
Bridgestone Tire Co., Tokyo (Japan); and Japan Ships Machinery Development Association, Tokyo. (Assignees).
M. Suzuki, and T. Yamajo.
U.S. Patent No. 4,138,340, 11 p, 13 fig, 10 ref; Official Gazette of the United States Patent Office, Vol. 979, No. 1, p 264, February 6, 1979.

Descriptors: *Patents, *Water pollution treatment, *Oil pollution, *Water quality control, Equipment, Endless belt conveyor.

An endless belt conveyor for selectively collecting high viscosity oil or coarse floating matter is disclosed. The endless belt conveyor extends between a pair of pulleys, one of which is located above water level and the other beneath water level. The conveyor comprises (1) a pair of driving bands located at widthwise ends of the conveyor, and synchronously driven together with the pulleys; (2) connection plates fixed to the driving bands at a given interval; (3) projections provided outwardly on the upper surface of each connection plate; (4) sleeves provided on the lower surface of each connection plate; and (5) flexible ropes passing through the sleeves and extending between the pulleys. (Sinha-OEIS)
W79-08222

AUTOMATED MEANS FOR HIGH VOLUME, DISCRETE DEPTH PLANKTON COLLECTING,
R. K. Hitch.
U.S. Patent No. 4,137,772, 4 p, 4 fig, 3 ref; Official Gazette of the United States Patent Office, Vol. 979, No. 1, p 72, February 6, 1979.

Descriptors: *Patents, *Sampling, *Plankton, Plankton nets, Equipment, Flowmeters, Flow measurement, Water quality control, Plankton collector.

A plankton collector is comprised of an open cylinder having a netting and motor with an attached propeller. The motorized propeller and netting are attached within the cylinder so that the propeller pulls water through the netting thereby concentrating the planktonic organisms. Flowmeters can easily be attached for quanitative measurement of the water flow. Two species of this invention are set forth. One species is designed to be tethered by its electrical cord in flowing water. The other species, has a portable power supply and is designed to be used by a submerged diver. (Sinha-OEIS)
W79-08228

SYSTEM FOR SEPARATING, REMOVING AND RECOVERING CONTAMINANT MATERIALS FROM A BODY OF WATER,
Oil Spill Recovery, Inc., Northbrook, IL. (Assignee).
M. D. Stagemeyer, and S. F. Allcorn.
U.S. Patent No. 4,139,470, 13 p, 21 fig, 16 ref; Official Gazette of the United States Patent Office, Vol. 979, No. 2, p 647-648, February 13, 1979.

Descriptors: *Patents, *Oil pollution, *Water pollution treatment, Water quality control, Skimming, Separation techniques, Vortices, Rotational flow, Equipment, Product recovery.

A system for removing and recovering contaminants from bodies of water utilizes a channeling device moving relative to the contaminated water to funnel it to a skimming apparatus. The skimming scoop direct the collected contaminant water mixture into cylindrical separator means, also moving relative to the contaminated body of water. Creation of a separation vortex within the separator cylinder separates the contaminant in an upward direction from the downwardly discharged water. At such time the contaminant is transported to storage facilities, free of the water upon which it floated for reclamation and/or reuse. (Sinha-OEIS)
W79-08232

BARRIER FOR OIL SPILLED ON WATER,
British Petroleum Co. Ltd., London (England). (Assignee).
L. Bretherick, D. H. Desty, and M. G. Webb.
U.S. Patent No. 4,140,424, 5 p, 3 fig, 6 ref; Official Gazette of the United States Patent Office, Vol. 979, No. 3, p 969, February 20, 1979.

Descriptors: *Patents, *Oil pollution, *Water pollution control, Water quality control, Barriers, Obstruction to flow, Containment.

An inflatable barrier for oil spilled on water comprises at least two air chambers one of which is a pilot air tube and one or more water chambers. The walls of all the chambers are formed of flexible material. When the air chambers have been inflated with air, the water chambers have been inflated with water and the barrier placed in water, the barrier will float with part below and part above the water surface so as to impede the passage of floating oil. The pilot air tube is quickly inflated and prevents sinking or twisting of the barrier prior to inflation of the air and water chambers. (Sinha-OEIS)
W79-08236

6. WATER RESOURCES PLANNING

6A. Techniques Of Planning

REGIONAL WATER PROGRAMS IN NORTH CAROLINA,
North Carolina State Board of Health, Raleigh. Sanitary Engineering Div.
J. A. Arnold.
Journal of the Environmental Engineering Division, Proceedings of the American Society of Civil Engineers, Vol. 105, No. EE2, p 183-187, April 1979.

Descriptors: *Water resources, *Programs, *Regional planning, *Water management(Applied), *North Carolina, *Regional development, Water quality, Government agencies.

The State of North Carolina has created two programs to aid in the establishment of regional water and sewer systems that have met with some success. The Regional Water Supply and Sewage Disposal Planning Program has met with financial difficulties that will require legislative action to correct. The Clean Water Bond Program, which extends construction grants to municipalities, has enabled several regional systems to gain adequate financing for construction. The separate State offices dealing with water and sewer projects should be combined, and greater support should be given to new and innovative designs for water resources systems. The State agencies could be more effective by sponsoring periodic workshops advocating regional systems and by encouraging the development of cluster systems. The ultimate goal should be the establishment of river-basin-wide regional systems. (Bell Graf-Cornell)
W79-08010

INTERACTIVE WATER RESOURCES PLANNING USING COMPUTER GRAPHICS,
Cornell Univ., Ithaca, NY.
P. N. French, L. E. Johnson, D. P. Loucks, and D. P. Greenberg.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-297 994, Price codes: A05 in paper copy, A01 in microfiche. Research Technical Completion Report, January 1979. 87 p, 56 fig, 15 ref, append. OWRT C-7183(6226)(4). 14-34-0001-6226.

Descriptors: *Water resources, *Planning, *Computer graphics, *Methodology, Water quality, Floods, Reservoir operation, Optimization, Simulation analysis, Multiple-purpose, Hydrologic aspects, Mathematical models, Equations, Systems analysis, Yield-capacity.

Computer-aided design methods for water resources planning using interactive computer graphics routines have been presented. Five specific types of problems, including water quality prediction, parameter identification, flood management, reservoir simulation, and multiobjective reservoir-water supply planning were illustrated. In all cases, tablet digitizing routines were used for the input of spatial and other data, and vector display methods were used for the graphical output. Visual feedback is provided at all stages of the procedures. The interactive computer graphics methods provide many advantages, including convenience, flexibility, the reduction of input errors, and improved communication and response time. (Bell-Graf--Cornell)
W79-08196

IRRIGATION PLANNING 1. CROPPING PATTERN,
California Univ., Davis. Dept. of Land, Air and Water Resources.
G. B. Matanga, and M. A. Marino.
Water Resources Research, Vol. 15, No. 3, p 672-678, June 1979. 5 tab, 22 equ, 10 ref.

Descriptors: *Irrigation efficiency, *Planning, *Cropping pattern, *Linear programming, *Benefit maximization, Programs, Optimization, Land allocation, Prices, Effects, Water supply, Equations, Mathematical models, Systems analysis, Sensitivity analysis.

Irrigation programs, specified in terms of dates and depths of irrigation, are developed for corn, grain, sorghum and pinto beans. The information contained in the irrigation programs for each crop is applied in an area-allocation model is a linear opti-

mization model which maximizes gross margin from yields of crops under consideration subject to total water supply, maximum amount of water that can be delivered for irrigation purposes on any date of irrigation, and irrigation labor. The land area to be allocated to each crop for planting is the decision variable. Results from the area-allocation model include cropping pattern, gross margin, total irrigation depth on each date of irrigation total irrigation labor, and crop yield. Sensitivity analysis is performed to study the effect of changes in crop prices on the optimal results. (See also W79-08202) (Bell-Graf--Cornell)
W79-08201

IRRIGATION PLANNING 2. WATER ALLOCATION FOR LEACHING AND IRRIGATION PURPOSES,
California Univ., Davis. Dept. of Land, Air and Water Resources.
G. B. Matanga, and M. A. Marino.
Water Resources Research, Vol. 15, No. 3, p 679-683, June 1979. 9 tab, 2 equ, 11 ref.

Descriptors: *Irrigation, *Planning, *Water allocation(Policy), *Leaching, *Stochastic processes, *Dynamic programming, Optimization, Simulation analysis, Water policy, Irrigation depths, Interseasonal model, Benefit maximization, Value iteration, Policy iteration, Davis(California), Salinity, Rainfall, Crops, Yield, Measurement, Climatic parameters, Cropping pattern, Mathematical models, Equations, Systems analysis.

For a finite or infinite planning horizon, an interseasonal model is employed to determine an irrigation policy in terms of leaching and seasonal irrigation depths. The interseasonal model employs stochastic dynamic programming and simulation to maximize gross margin over the planning horizon. Solutions to the model are obtained by value iteration and policy iteration methods for finite and infinite planning horizons, respectively, with research crop characteristics and measured climatic parameters from Davis, California. Salinity in the root zone of plants is defined as the state variable. A stage is a year commencing at the end of the rainy season. Seasonal rainfall is treated as a stochastic variable. The information provided by the interseasonal model is used in an area-allocation model that allocates acreage available for planting among the crops for unlimited and limited water supplies. (See also W79-08201) (Bell-Graf--Cornell)
W79-08202

PREFERENCE CRITERION FOR FLOOD CONTROL UNDER UNCERTAINTY,
Arizona Univ., Tucson. Dept. of Systems and Industrial Engineering.
R. Krzysztofowicz, and L. Duckstein.
Water Resources Research, Vol. 15, No. 3, p 513-520, June 1979. 4 fig, 4 tab, 2 equ, 30 ref.

Descriptors: *Real-time control, *Reservoir operation, *Multiple purpose, *Flood control, *Conservation control, *Decision making, *Risks, *Game theory, *Disutility model, Hydrology, Tradeoffs, Equations, Reservoir storage, Behavior, Systems analysis.

Real-time reservoir control may be reduced to the dual purpose problem of (1) flood control under uncertain inflow and (2) conservation control (water supply, power generation, low flow augmentation, recreation, etc.) after the flood has receded. Under this circumstance, the reservoir flood control is modeled as a game against nature. The decision maker makes the release decisions based upon his value judgments which express preferences over operating attributes and tradeoffs between reservoir purposes and upon his attitude toward risk. His decision behavior is described by a two-attribute disutility function. It is argued that minimization of expected disutility is a plausible and well-motivated criterion for reservoir flood control under uncertainty. Problems of application are discussed, and an experiment in assessing the disutility functions of individuals is reported. (Bell-Graf--Cornell)
W79-08205

SYSTMES ANALYSIS,
Cornell Univ., Ithaca, NY. Dept. of Environmental Engineering.
J. R. Stedinger, and J. M. Bell-Graf.
Journal of the Water Pollution Control Federation, Vol. 51, No. 6, Literature Review, p 1092-1098, June 1979. 61 ref.

Descriptors: *Water resources, *Systems analysis, *Mathematical models, *Analytical techniques, *Optimization, *Simulation analysis, *Management, *Water policy, *Literature reviews, Linear programming, Dynamic programming, Mixed-integer programming, Water quality, Lakes, Marine environment, Storm water, Salinity control, Water treatment, Waste water treatment, Design, Economic efficiency, Cost-benefit analysis, Cost minimization, Data collection, Planning.

Reviewed is a substantive cross section of the literature on systems analysis in water resources policy planning and management whic was published, or which became available to the public, during 1978. The books, articles, and conference proceedings summarized herein all have used analytical and mathematical modeling techniques to reach economically and operationally efficient decisions. Considered are water quality management, lake and marine environments, data collection, multicriterion decision making, wastewater treatment system design, control of treatment systems, stormwater control and management, salinity control, and river recreation management. A wide variety of simulation and optimization methodologies is represented, including the Vollenweider model 'overview modeling,' a dynamic eutrophication model, linear programming, least-squares estimation, mixed-interger programming, surrogate worth tradeoff method, branch and bound algorithm, and hierarchical dynamic programming. Besides the articles outlined, a bibliography containing some 60 references is included. (Bell-Graff--Cornell)
W79-08210

ON THE KROWN METHOD FOR FORECASTING SEASONAL RAINFALL IN ISRAEL,
Bar-Ilan Univ., Ramat-Gan (Israel). Dept. of Geography.
L. M. Druyan, and M. Cohen.
Israel Journal of Earth Sciences, Vol. 27, No. 1-2, p 85-87, 1978, 6 fig, 2 ref.

Descriptors: *Experimental models, *Hydrologic models, *Forecasting, *Analytical techniques, Rainfall disposition, Synoptic analysis, Israel, Weather patterns.

This examination of Krown's method (1966) of using certain synoptic characteristics of the October mean 500-mbar chart as predictors of the precipitation anomaly in Israel for the months of November, December and January illustrates that the plausible physical arguments set forth as support do not exclusively verify this technique as a reliable forecast method. October mean 500-mbar charts were examined for the years 1966-1976 and forecasts derived for the winter's precipitation anomaly using Krown's method to indicate that only six of the eleven forecasts agreed with observed data. It is concluded that Krown's method is unreliable and that its former successes were probably due to chance. (Tickes-Arizona)
W79-08364

COMPUTER MODELING OF GROUNDWATER AVAILABILITY IN THE POOTATUCK RIVER VALLEY, NEWTOWN, CONNECTICUT,
Geological Survey, Hartford, CT. Water Resources Div.
F. P. Haeni, and Elinor H. Handman.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-296 206, Price codes: A05 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 78-77, July 1978. 64 p, 16 fig, 11 tab, 23 ref.

Descriptors: *Groundwater resources, *Model studies, *Groundwater availability, *Water yield, *Water quality, Test wells, Well data, Aquifer characteristics, Surface-groundwater relationships, Groundwater recharge, Groundwater movement, Connecticut, *Pootatuck River valley, *Newton(Conn).

A hydrologic analysis of the stratified drift in Newtown, Conn., based on available data, test drilling, seismic refraction profiling, and the stream-aquifer connection was performed using a digital computer model. Simulated pumping indicates that a total of 4.0 million gallons of water per day (Mgal/d) can be withdrawn from the stream-aquifer system. A minimum of 2.5 Mgal/d is available for future development since Fairfield Hills Hospital is capable of withdrawing 1.5 Mgal/d. Induced recharge from the Pootatuck River supplies 65 percent, or 2.6 Mgal/d of the total pumpage, and captured ground-water outflow supplies the remaining 35 percent of 1.4 Mgal/d. The predicted yields are for long-term average hydrologic conditions; usually dry or extended drought periods would significantly reduce the water available from the aquifer. The quality of surface water in the valley as shown by seven samples from five sites, meets the Connecticut standards for public drinking water except for excessive coliform bacteria. Ground-water quality also meets these standards, as indicated by analyses of 20 samples from 14 wells and 1 spring, but high manganese (up to 15 mg/L) and iron (up to 1.7 mg/L) would require treatment prior to use. Trace metals from one surface-water and four ground-water samples are also within these standards, except for the high cadmium concentration of 26 micrograms per liter in water from one well. (Woodard-USGS)
W79-08393

MAGNITUDE AND FREQUENCY OF FLOODS FOR SMALL WATERSHEDS IN LOUISIANA,
Geological Survey, Baton Rouge, LA. Water Resources Div.
A. S. Lowe.
Louisiana Department of Transportation and Development, Office of Highways, Research Study 65-2H, 1979. 52 p, 10 fig, 3 tab, 10 ref, 2 append.

Descriptors: *Floods, *Peak discharge, *Flood frequency, *Flood forecasting, *Regression analysis, Louisiana, Small watersheds, Design flood, Surface runoff, Streamflow, Natural flow, Model studies, Statistical models, Equations, Rainfall-runoff relationships, Flood recurrence interval.

Statewide regression equations are defined for estimating peak discharges with recurrence intervals ranging from 2 to 100 years for streams draining less than 10 square miles (26 square kilometers). Contributing drainage area, main-channel slope, and mean annual precipitation are required for estimating the peak discharges. (Woodard-USGS)
W79-08397

THE CONFLICT OVER THE NEW RIVER AND THE TEST CASE FOR THE WILD AND SCENIC RIVERS ACT (COMMENT ON NORTH CAROLINA V. FPC),
North Carolina Central Univ., Durham.
For primary bibliographic entry see Field 6E.
W79-08418

COASTAL ZONE MANAGEMENT AND PLANNING IN CALIFORNIA: STRATEGIES FOR BALANCING CONSERVATION AND DEVELOPMENT,
For primary bibliographic entry see Field 6E.
W79-08430

PRINCIPLES FOR LOCAL ENVIRONMENTAL MANAGEMENT,
For primary bibliographic entry see Field 6E.
W79-08467

6B. Evaluation Process

RECREATION AND THE OHIO RIVER,
Louisville Univ., KY.
C. A. Leuthart, and H. T. Spencer.
Water Resources Bulletin, Vol. 15, No. 1, p 220-

226, February 1979. 3 fig, 2 tab, 5 ref.

Descriptors: *Recreation, Ohio River, *Boating, *Multiple-use waterways, Mooring facilities, Sampling, Urban centers, Hazards, Data collections, Dams, Locks, Coliforms, Water quality, Economic advantages.

The use of the Ohio River for recreational purposes is increasing. While documentation of the real-time use of the river for recreation is sparse, inferences are made from the availability of mooring facilities. The location of the facilities, the economic advantages of Ohio River recreation, and the hazards to such recreation coincide at the four major urban centers. Future use plans for the Ohio River must consider recreation among the multiple uses of this river. (Bell Graf-Cornell)
W79-08002

ENVIRONMENTAL READINESS DOCUMENT, SMALL SCALE LOW HEAD HYDRO, COMMERCIALIZATION PHASE III PLANNING.
Department of Energy, Washington, DC.
Available from the National Technical Information Service, Springfield, VA 22161 as DOE-ERD-0009, Price codes: A03 in paper copy, A01 in microfiche. Report No. DOE/ERD-0009, September 1978. 28 p, 2 fig, 5 tab, 2 append.

Descriptors: *Hydroelectric power, *Turbines, *Environmental effects, *Research and development, Evaluation, Costs, Dams, Dam sites, Impoundments, Technology, Marketing.

The uncertainties concerning small scale low-head hydropower technology which remain to be resolved through research and development are discussed. The characteristics of the technology are examined; status information on the technical and environmental research and development program is provided; the relationship between a considered commercialization schedule and relevant environmental research and development is charted; and environmental concerns significant to the technology are reviewed. There are three major environmental concerns associated with the retrofitting and management of low-head hydropower dam impoundments: (1) impacts on aquatic and semi-aquatic organisms; (2) effects on the downstream environments and organisms of the release of impounded chemicals and silt; and (3) use conflicts. The numerous major uncertainties associated with commercialization of low-head hydropower are represented in a diagram. Availability of sites suitable for either retrofitting old dams or building new dams is the major environmental constraint on the development of low-head hydropower. The likelihood and consequences of adverse findings, problems and uncertainties generated from current or anticipated environmental controls are examined. An assessment is made on the basis of this of the existing or potential barriers to commercialization. All conclusions are probable and based on the uncertainties which were diagrammed. There is only a low probability that an adverse finding will be determined in environmental research and development; probability is medium for technology program delays in the event of an adverse finding; and it is highly probable that energy costs will increase 10% in the event of an adverse finding. (Davison-IPA)
W79-08158

PROCEEDINGS OF A WORKSHOP ON INDEX CONSTRUCTION FOR USE IN HIGH MOUNTAIN WATERSHED MANAGEMENT.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-297 991, Price codes: A13 in paper copy, A01 in microfiche. Workshop held December 7-8, 1978, Logan, UT. Utah Water Research Laboratory, Utah State University, Logan, General Series UWRL/G-79/01, March 1979. James, L. D. Ed., 289 p, 33 fig, 31 tab, 250 ref, 1 append. OWRT C-80129-P(8407)(1).

Descriptors: *Decision making, *Management, *Land use, *Water resources development, Attitudes, Economics, Methodology, Planning, Forest management, Programs, Social aspects, Political aspects, Mountains, Watersheds.

The compilation of 12 papers from a workshop covers the areas of economic and social impact, ecological issues, and index construction to provide a foundation for continuing research in broadening the base of public participation in decision making in land and water planning. The topics covered include: Forest Service Study Plans; Economic Comparison of Management Options for High Mountain Watersheds; Social Assessment of Land Management Alternatives; An Identification and Evaluation of Strategies for Assessing Social Implications of Alternative Actions on Public Lands; Selection of Variables for Evaluation of Stream Ecosystems in Relationship to Watershed Activities; Stream Habitat and Its Physical Attributes as Influenced by Water and Land Management; General Approaches and Methodology for Construction of Indexes for Natural Resources Planning and Management; Index Utilization in Natural Resources Planning; Political Policy Effectiveness; A Comparison of Three Index Techniques in Use in Forest Service Planning; and Decision Analysis and High Mountain Watershed Planning. (Davison-IPA)
W79-08168

SOUTHEASTERN MICHIGAN (SEM) WASTEWATER MANAGEMENT SURVEY SCOPE STUDY, EVALUATION APPENDIX.
Army Engineer District, Detroit, MI.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A041 116, Price codes: A10 in paper copy, A01 in microfiche. 1973. 196 p, 22 tab, 15 fig.

Descriptors: *Michigan, *Waste treatment, *Waste water disposal, *Waste water treatment, *Water quality management(Applied), *Management, *Waste water treatment plants, Waste water(Pollution), Control, Industrial wastes, Municipal wastes, Sewage lagoons, Water pollution treatment, Regional analysis, Economics, Water quality, Aquatic life, Natural resources, Environmental effects, Social impact, Institutions, Land use, Public health, Employment, Planning.

The objective of the SEM study is to propose a regional wastewater management system. The purpose of this appendix is the consideration of factors not considered in engineering design. This evaluation has three objectives; to check the ability of the proposed system to achieve its primary goals; to evaluate the effects the system would have on the surrounding area; and to consider impacts on local, regional and national objectives. This evaluation is broken into several functional areas--ecologic, hygienic, economics, agricultural economics, social and aesthetic. An early evaluation of system components is made, including wastewater treatment methods, storm handling methods, and stormwater management. Preliminary alternatives are then formulated including investigations into advanced wastewater treatments, independent physical-chemical treatments, land irrigation treatments and combination treatments. These preliminary alternatives are evaluated in terms of water quality, aquatic life and waterfowl, public health, energy and natural resources, employment, land and water use changes, land values, area economy and institutions, socio-economics and system costs. A revised concept for land irrigation treatment is presented and evaluated. Lastly three final alternatives are selected, one emphasizing regional wastewater treatment plants, one including both regional plants and land irrigation, and one calling for the major portion of the region's wastewater to be treated in the plant system common to all plans, but with land irrigation for treating both municipal-industrial wastewater and stormwater in two specific areas. Each alternative is evaluated. No final recommendation is made. (Zayac-NC)
W79-08171

SOUTHEASTERN MICHIGAN (SEM) WASTEWATER MANAGEMENT SURVEY SCOPE STUDY, COMMENTS APPENDIX,
Army Engineer District, Detroit, MI.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A041 114, Price codes: A06 in paper copy, A01 in microfiche. 1974. 96 p.

Descriptors: *Waste water treatment, *Water quality management, *Michigan, *Evaluation, *Public meetings, *Public participation, *Public comment, Public access, Institutions, Reviews, Management, Planning, Regional analysis, Waste water disposal, Agencies.

The objective of the SEM study is to propose a regional wastewater treatment system. The purpose of this appendix is to present the views expressed by government agencies and interested citizen groups and individuals, based on their review of the draft report and the response of the Detroit District to their comments. The comments received were varied; concerns centered around system costs and source of funds to operate such systems, use of rich agricultural land for waste treatment, and allocation of energy resources to wastewater treatment. A cursory summary of comments received and responses is presented, followed by two attachments. The first attachment contains comments by interested agencies. The second attachment contains statements presented at the Public Meetings held on 11, 12 and 13 December 1973. (Zayac-NC)
W79-08172

PROCEEDINGS OF A SEMINAR ON NON-STRUCTURAL FLOOD PLAIN MANAGEMENT MEASURES,
Hydrologic Engineering Center, Davis, CA.
For primary bibliographic entry see Field 2E.
W79-08173

A STUDY OF WATER QUALITY ALTERNATIVES FOR THE CITY OF LAKE CHARLES, LOUISIANA,
Lake Charles-McNeese Urban Observatory, LA.
W. E. Hohnstein, and G. Hicks.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-278 731, Price codes: A04 in paper copy, A01 in microfiche. Report No. UO-LCCM-LAC-77-016, December 1977. 58 p, 13 tab. H-2196R.

Descriptors: *Water supply, *Water management, *Water rates, *Water levels, *Lake Charles(LA), Water storage, Economics, Income, Utilities, Financing, Government finance, Marginal costs, Water demand, Water costs, Capital costs, Louisiana, Price index.

The origin and present condition of the Greater Lake Charles Water Company are detailed in this report. The Company has served the City of Lake Charles as the only public supplier of water since 1956. In 1990 the Company will become property of the City of Lake Charles when its original bond is liquidated. The authors describe the creation of the Company as a non-profit organization with ties to the city government but isolated from its political atmosphere. The documents creating the Company, governing its financial operations, and outlining its organizational structure are presented with an analysis of present relations between the Compay and the City Council. The authors investigate the possibility of improving and raising the reliability of water service in Lake Charles by changing the ways the Company relates to city government. The importance of water rates is examined because regardless of the nature of the Company charter, these rates will be fixed by Administrative decision and not determined in a free market. The authors discuss the economics of water production and pricing. Rates in other cities, marginal cost concepts, rate structure and demand, and cost concepts are some of the topics discussed. A number of general conclusions are presented. (Coan-NC)
W79-08176

ESTABLISHMENT OF OPERATIONAL GUIDELINES FOR TEXAS COASTAL ZONE MANAGEMENT: WATER NEEDS AND RESIDUALS MANAGEMENT,
Texas Univ., at Austin. Div. of Natural Resources and Environment.
J. S. Sherman, and J. F. Malina, Jr.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-282 156,

Price codes: A09 in paper copy, A01 in microfiche. Report No. NSF-RA-E-74-090, 1974. 176 p. GI34870X.

Descriptors: *Water utilization, *Water resources, *Coasts, *Water quality, *Water treatment, *Texas, *Corpus Christi Bay Area(TX), *Coastal Zone Management, Water demand, Water management(Applied), Regional planning, Land use, Economics, Wastewater, Air pollution, Urban runoff, Solid wastes.

271 objective of the Texas Coastal Zone Management Project is the development and evaluation of a methodology for effective management of the Texas Coastal Zone. This methodology will include the quantitative and qualitative assessment of water requirements and residuals generation to determine the future water requirements and residual loads resulting from predicted levels of economic activity and population resulting from three hypothetical coastal zone management policies. The area for which the methodology was tested was the 13 county Coastal Bend Council of Governments region with particular emphasis on the Corpus Christi Bay Area. Data were collected for: (1) water use patterns of municipal, industrial, and agricultural consumers; (2) wastewater flows from municipal wastewater treatment plants, industrial return flows and storm runoffs; (3) solid waste generation from municipalities and industries; and (4) air emissions from automobiles and industries. Mathematical models are presented to predict rainfall-runoff relationships, water quality, wastewater treatment costs, and industrial water use as a function of employment. Appendices contain information on standard industrial classifications, industrial water use and solid waste generation. Conclusions are offered concerning the availability of fresh water supplies, the wastewater and solid waste disposal situation, and the air pollution potential of the area. (Coan-NC)
W79-08180

WATER NEEDS AND RESOURCES. RATIONAL MANAGEMENT: THE KEY TO THE SUPPLY-DEMAND EQUATION,
United Nations Educational, Scientific and Cultural Organization, Paris (France). Natural Resources and Environmental Sciences.
For primary bibliographic entry see Field 6E.
W79-08182

ECONOMIC IMPACTS OF ADMINISTRATIVE WATER LAW SYSTEMS,
Florida Univ., Gainesville. Dept. of Food and Resource Economics.
C. Kiker, and G. D. Lynne.
Transactions of the ASAE, Vol. 22, No. 1, p 115-121, Jan.-Feb. 1979. 19 equ, 20 ref.

Descriptors: *Economic impact, *Economic efficiency, *Water law, *Water allocation(Policy), *Florida, *Water rights, *Administrative regulation, Eastern U.S., Equations, Systems analysis, Production model, Prices, Marketing, Common law doctrines, State level, Private uses.

A move to administrative regulation of water is taking place in the eastern states. Private entitlements to water are being allocated on technically-based criteria which ignore economic efficiency. Wasteful water use can result. Allocation procedures utilizing economic criteria can increase net benefits from water use. Several allocation alternatives including a technical approach, the western appropriation doctrine, a limited economic information approach, and a pseudo-market are examined. Discussed is water law in the eastern states. Described is a conceptual model serving to clarify the issues under consideration; the production model allows comparison of the suggested alternatives for water allocation. Emphasized are economic efficiency impacts, but economic distribution is also an important consideration in water management. (Bell-Graf--Cornell)
W79-08200

A MODEL TO GENERATE RENT SURFACES: APPLICATIONS AND RESULTS FOR A PUBLIC PROJECT,
John F. Kennedy School of Government, Cambridge, MA.
P. F. Ricci, E. R. Glaser, and R. E. Laessig.
Water Resources Research, Vol. 15, No. 3, p 539-545, June 1979. 5 fig, 1 tab, 7 equ, 19 ref.

Descriptors: *Rent surfaces, *Public investment, *Fourier series expansion, *Distance, Projects, Parks, *Lakes, Land values, Reservoirs, Economic impact, Estimating, Equations, Statistical methods, Project activities, Gravity modeling, Mathematical models, Systems analysis.

Suggested is an alternative approach to modeling rents generated by a public investment. The formulation adopted adds direction, through a Fourier series expansion, to distance--the independent variable of potential models. The coefficients of the enhanced model are estimated statistically and the resulting equations utilized to generate rent equipotentials. The proposed formulation enables the representation of the various influences that intervene to disturb the otherwise smooth rent surfaces normally obtained from a potential model. The economic impact of a newly developed park-lake complex is studied to provide an application of the methodology developed. Land values from deed records, the dependent variable of the model, are regressed against distance and direction from the centroid of the park-lake complex. The findings show that rent surfaces change in configuration as different project-related activities take place. For example, construction of the reservoir increases land values nearby the park-lake, while the lack of visible activities does not affect land values. (Bell-Graf--Cornell)
W79-08203

WATER TRADE-OFF BETWEEN ELECTRIC ENERGY AND AGRICULTURE IN THE FOUR CORNERS AREA,
New Mexico Univ., Albuquerque. Dept. of Economics.
M. Gisser, R. R. Lansford, W. D. Gorman, B. J. Creel, and M. Evans.
Water Resources Research, Vol. 15, No. 3, p 529-538, June 1979. 1 fig, 10 tab, 17 ref.

Descriptors: *Electric energy, *Agriculture, *Estimating, *Economic impact, *Linear programming, *Benefit maximization, *Irrigation, Navajo Indian regions, Projects, Farms, Demand, Shadow prices, Constraints, Optimization, Employment, Water allocation(Policy), Mathematical models, Systems analysis.

The results of estimating the economic impact of the growing electric generating sector on agriculture are given. A linear programming (LP) model was designed to represent agriculture in three subregions and the Navajo Indian Irrigation Project. The assumption was made that the electric generating sector will purchase water from farmers. The impact of shifting water from agriculture to the electric generating sector was evaluated by reducing the water allocation for agriculture at discrete steps, and after each reduction the LP model was run. Changes in the shadow prices of water, farm income, and employment were calculated after each linear programming run. Regional multipliers (at the county level) were applied to gauge the impact on the regional economy. The model maximized net revenue. It was concluded that commercial farms would be able to sell water to the energy sector by switching from flood irrigation to sprinklers. Part-time farmers would reduce their cultivated acreage. Farmers would need relatively large funds to invest in sprinklers. For the utilities, the cost of the water would be relatively insignificant. (Bell-Graf--Cornell)
W79-08204

MULTI-GOAL ANALYSIS OF A SHORT-RUN RESERVOIR OPERATION,
Milan Univ. (Italy). Inst. di Elettrotecnica ed Elettronica and Consiglio Nazionale delle Ricerche, Milan (Italy). Centro di Teoria dei Sistemi.
For primary bibliographic entry see Field 4A.
W79-08206

A SCREENING MODEL FOR PLAN FORMULATION IN SOUTHEASTERN NEW ENGLAND, VOLUME 1, PART I -- IV,
Massachusetts Inst. of Tech., Cambridge. Dept. of Civil Engineering.
D. H. Marks, E. Johnson, D. Wood, P. Deese, and M. Baram.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-298 491, Price codes: A19 in paper copy, A01 in microfiche. Research Report NO. R77-19, June 1977. 434 p, 65 fig, 12 tab, 191 ref, 4 append. OWRT-C-5241(No. 4236) (1), 14-31-0001-4236.

Descriptors: *Model studies, *Water resources development, *Planning, *Land use, Mathematical models, Computer, Programs, Methodology, Legal aspects, Social aspects, Political aspects, Institutions, Economics, Southern New England Water and Related Land Resources Study.

The economic, social, institutional and physical relationships associated with developing, using, implementing, adjusting, and supporting useful and useable planning-oriented water and land use models are examined and discussed. This two-year study, sponsored in part by the Office of Water Research and Technology, focused on the 'Southeastern New England Water and Related Land Resources Study' (SENE Study) to develop tools and recommendations which may be applied to similar water and related land use planning efforts. Part I of Volume I presents a description of the SENE planning methodology, explains the role of a screening model in planning, and provides the mathematical formulation for such a model. In Part II the inherent difficulties associated with traditional control approaches are discussed, and an innovative 'performance control' approach is presented in which its legal, political, technical and institutional aspects are surveyed; application criteria are suggested. A linear systems model to predict the hydrologic consequences of land use development is developed in Part III, and a user's manual for the screening model is provided in Part IV. (See W79-08272 and W79-08273) (Davison-IPA)
W79-08271

A SCREENING MODEL FOR PLAN FORMULATION IN SOUTHEASTERN NEW ENGLAND, PART V: PERSPECTIVES AND TOOLS FOR COPING WITH SOCIOTECHNICAL ENGINEERING SYSTEMS,
Massachusetts Inst. of Tech., Cambridge. Dept. of Civil Engineering.
S. A. West, and J. C. Spencer.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-298 492, Price codes: A08 in paper copy, A01 in microfiche. Research Report No. R77-20, December 1977. 159 p, 8 fig, 6 tab, 55 ref. Volume 2 of 3. OWRT-C-5241(No. 4236) (1), 14-31-0001-4236.

Descriptors: *Planning, *Social participation, *Water resources development, *Land use, *Social aspects, Systems analysis, Computer models, Management, Methodology, Regional development, Engineering, Southeastern New England Water and Related Land Resources Study.

The role of the planner in water resources development and related land use is changing from one where planning is conducted in an objective and scientific manner to one where planning is facilitated by soliciting public involvement. Two of the basic limitations of systems analysis which limit its use for planning human societies are: (1) the systems are of little use in formulating a precise, operational problem statement, and (2) the system methods do not aid human judgment. A discussion on human judgment includes recent developments such as the use of computer tools to aid learning and enable users to have new insights. Engineering problems necessitating the exercise of judgment are the inheretbly sociotechnical problems transcending the technical demands of purely physical systems, and problems dealing with physical systems for which no single solution is possible. The disadvantages of systems analysis related to the preparation and use of social indicators are examined. Six judgment heuristics are set forth and

discussed. A retrospective view of how the 'Southeastern New England Water and Related Land Resources Study' (SENE Study) might have been conducted had it been guided by this study. (See also W79-08271) (Davison-IPA)
W79-08272

A SCREENING MODEL FOR PLAN FORMULATION IN SOUTHEASTERN NEW ENGLAND, PART VI: LAND USE CAPABILITY MAPPING,
Massachusetts Inst. of Tech., Cambridge. Dept. of Civil Engineering.
K. Twyford, and G. B. Baecher.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-298 493, Price codes: A07 in paper copy, A01 in microfiche. Research Report No. R78-17, June 1978. 131 p, 43 fig, 4 tab, 52 ref, 5 append. Vol. 3 of 3. OWRT C-5241-(No. 4236) (1), 14-31-0001-4236.

Descriptors: *Mapping, *Land use, Land resources, Capability mapping, Land management, Maps, Evaluation, Measurement, Spatial distribution, Computer programs, Computer models.

The need for more well founded methodologies for landscape resource evaluation, or 'capability mapping' are examined. Capability mapping can be applied to a large set of problems besides land-use planning. Examples of problems involving spatially defined objective functions include waste disposal siting, mineral exploration, and economic location analysis among many others. Simple modifications of existing techniques or combinations of techniques and use of evaluation theory directly to develop a new methodology are considered. Current mapping schemes ranging from hand drawn overlays to computer weighting programs are summarized. Fundamentals of measurement theory bearing on capability mapping are reviewed, and deficiencies in present techniques are discussed. The concepts of value and utility functions are presented, and a mapping scheme based on these concepts is developed. Previous uses of computers to generate and evaluate capability maps are summarized, and the value/utility theory program developed in the course of this work is presented. (See also W79-08271) (Schaefer-IPA)
W79-08273

PUBLIC AND PRIVATE IMPACTS OF ALTERNATIVE FLOOD ASSISTANCE, INSURANCE, AND RECOVERY EFFORTS,
Cornell Univ., Ithaca, NY. Dept. of Agricultural Economics.
R. N. Boisvert, and M. J. Rettger.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-298 362, Price codes: A02 in paper copy, A01 in microfiche. Technical Completion Report. Center for Environmental Research, Cornell University, Ithaca, New York, May 1979. 12 p, 3 tab, 4 equ, 9 ref. OWRT A-074-NY (2), 14-34-0001-7068.

Descriptors: *Water resources, *Simulation analysis, *Flood insurance *Disaster loans, *Economic impact, Mathematical models, Systems analysis, Equations, Programs, Costs, Benefits, Evaluation, Sensitivity, Binghamton(NY).

Alternative federal flood disaster assistance programs are evaluated through an economic comparison of flood insurance and disaster loan programs. The distribution of costs, benefits, and program transfers, both private and public, are simulated over time and are analyzed to determine the sensitivity of program performance to specific program parameters. Empirical results for the Binghamton, New York area demonstrate that both programs provide adequate levels of protection at approximately equivalent costs. Variations in premium and interest rate subsidies have major effects on the distribution of total costs between the public and private sectors.
W79-08274

ANALYSIS OF UNCERTAINTY IN FLOOD PLAIN MAPPING,
Washington Univ., Seattle. Dept. of Civil Engineering.
For primary bibliographic entry see Field 2E.
W79-08340

ALTERNATIVE FUTURES PLANNING,
SYNERGY Consultation Services, Saratoga, CA.
J. L. Creighton.
Report prepared for Bureau of Reclamation, Denver, Colorado, August 1976. 269 p, 44 fig, 4 append.

Descriptors: *Planning, *Future planning(Projected), *Alternative planning, Water utilization, Water resources development, Water resources, Management, Alternative water use, Administration, Methodology, Projections, Social aspects, Costs, Lake County(California), Napa County(California), Yolo County(California), Solano County(California).

Procedures were developed which involve the public in projecting alternative futures in water needs planning. These planning procedures were applied as a study of the total water needs of Lake, Napa, Yolo, and Solano Counties in California. A method of evaluating alternatives is provided which attempts to protect, rather than foreclose, the options represented by the alternative futures. The major steps in the study were: (1) developing scenarios, (2) identifying water demands, (3) developing alternative plans, (4) cross-impacting the plans, (5) developing an operating plan, and (6) developing a decisionmaker's guide. A work plan was also developed which estimated time and costs for the study based on normal planning procedures to establish a standard for comparing costs and time in utilizing the alternative futures planning procedures. It is concluded that the procedures developed provide visibility to the assumptions made in the study so that the necessary corrections needed can be made to make the outcome of the study a continuing decision making process instead of a one-time product. (Davison-IPA)
W79-08352

PRELIMINARY OBSERVATIONS ON THE PROSPECTS OF REARING TROUT IN CAGES IN RHODESIAN IMPOUNDMENTS,
Department of National Parks and Wild Life Management, Inyanga Trout Research Centre, Inyanga (Rhodesia).
A. R. Macgown.
Rhodesia Science News, Vol. 10, No. 6, p 157-158, June 1976. 3 fig.

Descriptors: *Trout, *Rainbow trout, *Impoundments, *Fish farming, Fish management, Agriculture, Fish, Cold-water fish, Reservoir fisheries, Design, Rhodesia.

There have been few attempts at culturing trout in cages in standing fresh waters. Because there is not, in this type of situation a substantial, continuous and infallible flow of fresh water to carry off waste products and bring in fresh and adequately oxygenated water, metabolite disposal or dispersal takes place through the mesh of the cage and dissolved oxygen enters by the same route. A small sized cage of shallow depth made of woven black steel mesh met the requirements for space, visibility, availability, and durability. A square wooden frame around the cage gave it rigidity; floats were of expanded polystyrene or fuel drums. Experiments were conducted using cages with volumes of 1.17 and 2.63 cubic meters. The cages were anchored at a total depth of 3 meters in the Mare Dam, Inyanga National Park. Nine month old rainbow trout were used as stock. Fish were fed trout pellets twice daily. After four months fish density had increased about 50%. Mortality during the first six months was less than 1%. The trial showed that rainbow trout can be successfully and economically reared under such conditions. Further trials are in progress to determine criteria for smaller fish, maximum cage concentrations, and spacing distance for cages. (Schaefer-IPA)
W79-08360

THE CLEAN WATER ACT OF 1977: GREAT EXPECTATIONS UNREALIZED,
For primary bibliographic entry see Field 6E.
W79-08420

THE WILLAMETTE BASIN COMPREHENSIVE STUDY OF WATER AND RELATED LAND RESOURCES: APPENDIX C--ECONOMIC BASE,
Pacific Northwest River Basins Commission, Portland, OR. Willamette Basin Task Force.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A036 748, Price codes: A13 in paper copy, A01 in microfiche. Chaired by the U.S. Corps of Engineers, 1969, 242 p, 11 addenda, 87 tab, 18 fig, 7 maps, 34 photos.

Descriptors: *Planning, *Economics, *Industries, *River basin development, *Water resources, *Land resources, *Willamette River(OR), Oregon, Economic impact, Employment, Income distribution, Industrial production, Regional economies, Social impacts, Economic efficiency, Optimum development plans, Income analysis, Employment, Chemical industry, Agriculture, Lumbering, Food processing, Electric power industry, Food processing industry, Pulp and paper industry, Governments, Regional analysis, River basins, Manufacturing, Population.

This study was undertaken to plan for the proper development of water and related land resources of the Willamette Basin in Oregon. Appendix C, along with Appendices A and B, provides supporting data for the functional Appendices D through L. It contains economic data intended to aid in the determination of the scale, sequence, and timing of water and related land resources development. A method of analysis is outlined early in the study including a description of the nature and pattern of economic change and projection techniques. Present economic status is described in terms of population, personal income and employment; in these descriptions, data are presented by region, basin, and subbasin. Industry studies are undertaken. The agricultural economy is discussed in terms of its characteristics, land resources, and projections. Food processing, forest products industries, mining and mineral industries, primary metals (including silicon, ferroalloys, aluminum, and steel), and the chemical products industry are all reviewed in detail. The final section presents projections by employment in the basic industries--agriculture, mining, manufacturing, government--and residentiary industries. Projections of population and personal income estimates are also included. (See also W79-08433) (Zayac-NC)
W79-08436

WILLAMETTE BASIN COMPREHENSIVE STUDY OF WATER AND RELATED LAND RESOURCES: APPENDIX J--POWER.
Pacific Northwest River Basin Commission, Portland, OR. Willamette Basin Task Force.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A036 762, Price codes: A06 in paper copy, A01 in microfiche. Chaired by Bonneville Power Administration, 1969, 74 p, 14 tab, 9 fig, 7 maps, 15 photos, glossary.

Descriptors: *Hydroelectric plants, *Power marketing, *Electric power, *Electric power production, *Power line carriers, *Power plants, *River basin development, Oregon, Power head, Reservoirs, Economics, Electric power costs, Electric power demand, Electric power industry, Power operation and maintenance, Operating costs, Maintenance costs, Power system operation, Electric power failure, Proprietary power, Transmission lines, Hydroelectric plants, Nuclear power plants, Thermal power plants, Pumped storage, Reservoir operation, Pump turbines, River basins, Peak power, *Willamette River(OR).

This study was undertaken to plan for the proper development of water and related land resources of the Willamette River Basin in Oregon. Appendix J - one of the functional appendices - is based on data contained in the three supporting appendices, A through C. Present power needs are outlined by looking at power requirements, load characteristics, power sources, power transmission, and

special problems. Electric power requirements are assessed in a discussion of future demand. Short-term (immediate) projections are made for domestic, irrigation, commercial, and industrial needs. Long-term projections are made to the year 2020. Alternatives for both power resources and transmission facilities are studied. Among the power resources reviewed are 'conventional' hydroelectric plants, pumped-storage plants, fossil-fueled plants, and nuclear-fueled plants. The study of transmission facilities includes an assessment of land requirements, research and development, and the effects of thermal plant location. The findings indicate that the Basin's future power demands will most likely be met by increased imports from outside the Basin, from nuclear power plants to supply around-the-clock base loads, and from pumped-storage to supply peaking. The Basin has no significant fossil fuel supply; development of this type of generation would therefore require importation of these fuels. Since transportation costs are quite high, fossil-fueled plant construction is inhibited. Finally, the potential for large-scale conventional hydro-power is limited, although small conventional plants may be developed to supplement both base and peak load power supplies. (See also W79-08433) (Zayac-NC)
W79-08443

WILLAMETTE BASIN COMPREHENSIVE STUDY OF WATER AND RELATED LAND RESOURCES: APPENDIX K--RECREATION,
Pacific Northwest River Basins Commission, Portland, OR. Willamette Basin Task Force.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A036 763, Price codes: A14 in paper copy, A01 in microfiche. Chaired by the U.S. Bureau of Outdoor Recreation, 1969, 174 p, 37 tab, 12 maps, 90 photos.

Descriptors: *Recreation, *Recreation demand, *Planning, *River basin development, *Outdoor recreation, *Water resources development, Oregon, Economics, Social needs, Social participation, Water demand, Recreation facilities, Recreation wastes, Water pollution sources, Aesthetics, Environmental effects, Attitudes, Reservoirs, Public health, Water policy, Silting, Non-structural alterntives, Natural resources, Archaeology River basins, Boating, *Willamette River(OR).

This study was undertaken to plan for the proper development of water and related land resources of the Willamette River Basin in oregon. The purpose of Appendix K is to assess recreation in the study area with respect to the present and future effects on the land, water, and overall economy of the area. This functional appendix relies on data contained in the three supporting Appendices, A through C. The present status of recreation resources is reviewed by looking at accessibility, recreation use, economic impacts of outdoor recreation, and preservation of irreplaceable values. Problems including conflicting demands, reservoirs vs. free-flowing streams, contamination, overuse and missuse, silting, and recreation supply are outlined as a lead-in individual subbasin analyses for the 11 subbasins in the area. Future demand is estimated by studying demand variables and assessing recreational needs. These needs are then allocated by subbasin. Lastly, alternative means to satisfy demand are discussed. Considerations such as water storage, private vs. public development, municipal recreation, land use, and land acquisition are assayed. Institutional responsibility is deliberated. Recommendations such as water storage, private vs. public development, municipal recreation, land use, and land aquisition are are assayed. Institutional responsibiliyt is deliberated. Recommendations include emphasizing land use controls and non-structural measures to facilitate recreation development; estalishing an interagency task force to monitor development; acdelerating public information and education programs; and initiating a study to identify and protect irreplaceable resources of natural, archaeological, and historical interest. (See also W79-08433) (Zayac-NC)
W79-08444

PRINCIPLES FOR LOCAL ENVIRONMENTAL MANAGEMENT,
For primary bibliographic entry see Field 6E.
W79-08467

WATER POLLUTION CONTROL (ASSESSING THE IMPACTS AND COSTS OF ENVIRONMENTAL STANDARDS),
For primary bibliographic entry see Field 6E.
W79-08468

6C. Cost Allocation, Cost Sharing, Pricing/Repayment

COST SHARING AND IMPLEMENTATION OF NATIONAL WATER RESOURCES POLICY,
Georgia Univ., Athens. Inst. of Natural Resources.
J. Sellers, and R. M. North.
Water Resources Bulletin, Vol. 15, No. 1, p 189-197, February 1979. 3 tab, 14 ref.

Descriptors: *Water resources, *National policy, *Cost sharing, Economic development, Managerial approach, Multiple objectives, Environmental quality, Conservation.

In this article a managerial approach to developing and implementing National Water Resources policy is suggested. Proper consideration can be given to national economic development (NED), environmental quality (EQ), and conservation and still result in an implementable policy at the operational level if proper incentives are built into the process with proper attention given to alternate non-Federal cost sharing rates. Not only can these multiple objectives be entertained, but the Administration and Congress will have a management tool that should ensure a certain probability of success. (Bell Graf-Cornell)
W79-08011

OPTIMAL PRICING AND REGULATION OF ELECTRIC ENERGY IN A SYSTEM DEPENDING ON HYDROELECTRIC CAPACITY,
Idaho Univ., Moscow. Dept. of Economics.
R. A. Lyman.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-298 013, Price codes: A04 in paper copy, A01 in microfiche. Idaho Water Resources Research Institute, Idaho University, Research Technical Completion Report, May 1979. 62 p, 7 fig, 15 tab, 30 ref, 1 append. OWRT A-059-IDA(1). 14-34-0001-8014.

Descriptors: *Electric power, *Electric power demand, *Peak power, *Electric power rates, Peak loads, Power marketing, Reservoir operation, Electric power costs, Rates, Hydroelectric power, Idaho.

The benefits and costs of alternative regulatory policies in pricing electric power are evaluated on normative grounds. The effects of these policies on seasonal electric loads, hydroelectric generation, and seasonal reservoir fluctuation are analyzed with respect to residential, commercial, and industrial customer classifications in the North Idaho Service Area of the Washington Water Power Company. Results of this study establish the benefits of seasonal, peak-load pricing in Northern Idaho. Although time-of-day pricing may not be desirable for residential and commercial customers, industrial customers would benefit. The optimal pricing strategy is one with a two-part schedule pricing scheme which includes a 'usage' price for power set at marginal cost in each pricing period and a dividend program for equity adjustment between stockholder and customer. It is concluded that even though a conservative approach should be used in interpreting the results, important effects can be expected in terms of seasonal operation of certain reservoirs. (Davison-IPA)
W79-08165

RELATIVE VALUE OF WATER AND LAND OUTDOOR RECREATION ACTIVITY AREAS,
Idaho Univ., Moscow. Coll. of Forestry, Wildlife and Range Sciences.
J. E. Hoffman.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-297 996, Price codes: A05 in paper copy, A01 in microfiche. Idaho Water Resources Research Institute, Idaho University, Research Technical Completion Report, April 1979. 75 p, 8 fig, 16 tab, 10 ref, 5 append. OWRT A-055-IDA (1), 14-34-0001-7027 & 7028.

Descriptors: *Recreation, *Recreation facilities, *Parks, *Management, *Cost allocation, *Social participation, Planning, Fishing, Boating, Swimming, Camping, Economic impact, Social aspects, Attitudes, Water utilization.

In implementing a methodology to ascertain the cost effectiveness of each activity area at the Heyburn State Park, Idaho, the relative value of each activity was measured by the paid comparison method, and the preference-cost ratio or efficiency index for selected activities was determined by comparing the relative value of the activity with the management cost of providing the area for the activity. The four sets of activities measured were: (1) fishing, boating, swimming, hiking, camping, and picnicking; (2) dock fishing, boat fishing, and shore fishing; (3) water skiing, motorboat fishing, and motorboating; and (4) canoeing, sailboating, and motorboating. The relative values provide a measure of distance between activities of a set along a preference scale, and preference-cost ratios identify where unequal resource allocations are occurring. In terms of preference/cost ratios hiking, boating, and fishing were the most efficient activities; the least efficient were swimming, picnicking, and camping. Although allocating more management money may lead to a more equitable distribution of funds based on preference/cost ratios, it may or may not change the preference scale value for an activity. (Davison-IPA)
W79-08166

A STUDY OF WATER QUALITY ALTERNATIVES FOR THE CITY OF LAKE CHARLES, LOUISIANA,
Lake Charles-McNeese Urban Observatory, LA.
For primary bibliographic entry see Field 6B.
W79-08176

FINANCIAL RESPONSIBILITY FOR WATER POLLUTION-OUTER CONTINENTAL SHELF (FINAL RULE).
Federal Maritime Commission, Washington, DC.
For primary bibliographic entry see Field 6E.
W79-08409

OFFSHORE OIL POLLUTION COMPENSATION FUND AND CLAIMS PROCEDURES (FINAL RULES).
Coast Guard, Washington, DC.
For primary bibliographic entry see Field 6E.
W79-08410

THE CHANGING WATER MARKET FOR ENERGY PRODUCTION,
McGeorge School of Law, Sacramento, CA.
For primary bibliographic entry see Field 6E.
W79-08432

PRINCIPLES FOR LOCAL ENVIRONMENTAL MANAGEMENT,
For primary bibliographic entry see Field 6E.
W79-08467

6D. Water Demand

DISTRIBUTIVE POLITICS RECONSIDERED--THE WISDOM OF THE WESTERN WATER ETHIC IN THE CONTEMPORARY ENERGY CONTEXT,
Arizona Univ., Tucson. Dept. of Political Science.
For primary bibliographic entry see Field 6E.
W79-08162

ESTABLISHMENT OF OPERATIONAL GUIDELINES FOR TEXAS COASTAL ZONE

MANAGEMENT: WATER NEEDS AND RESIDUALS MANAGEMENT,
Texas Univ., at Austin. Div. of Natural Resources and Environment.
For primary bibliographic entry see Field 6B.
W79-08180

RESERVED WATER RIGHTS FOR FEDERAL AND INDIAN RESERVATIONS: A GROWING CONTROVERSY IN NEED OF RESOLUTION.
Comptroller General of the United States, Washington, DC.
For primary bibliographic entry see Field 6E.
W79-08185

AVAILABILITY OF ADDITIONAL GROUNDWATER SUPPLIES IN THE PASCAGOULA AREA, MISSISSIPPI,
Geological Survey, Jackson, MS. Water Resources Div.
For primary bibliographic entry see Field 4B.
W79-08387

GOVERNORS SEEK A WATER POLICY THAT HAS SOMETHING FOR EVERYONE,
For primary bibliographic entry see Field 6E.
W79-08427

WILLAMETTE BASIN COMPREHENSIVE STUDY OF WATER AND RELATED LAND RESOURCES: APPENDIX F -- IRRIGATION.
Pacific Nothwest River Basins Commission, Portland, OR. Willamette Basin Task Force.
For primary bibliographic entry see Field 3B.
W79-08439

WILLAMETTE BASIN COMPREHENSIVE STUDY OF WATER AND RELATED LAND RESOURCES: APPENDIX H--MUNICIPAL AND INDUSTRIAL WATER SUPPLY.
Pacific Northwest River Basins Commission, Portland, OR. Willamette Basin Task Force.
For primary bibliographic entry see Field 3B.
W79-08441

WILLAMETTE BASIN COMPREHENSIVE STUDY OF WATER AND RELATED LAND RESOURCES: APPENDIX 1--NAVIGATION,
Pacific Northwest River Basins Commission, Portland, OR. Willamette Basin Task Force.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A036 761, Price codes: A05 in paper copy, A01 in microfiche.
Chaired by U.S. Army Corps of Engineers, 75 p, 10 tab, 6 fig, 2 maps, 19 photos, 3 addenda. 1969.

Descriptors: *Navigation, *Navigable waters, *Navigable rivers, *Transportation, *River basin development, *Waterborne commerce, *Water resources development, Oregon, Harbors, Locks, Economics, Bank stabilization, Channel improvement, Planning, Inland waterways, Equipment, River basins, *Willamette River(OR), Bulk commodities.

This study was undertaken to plan for the proper development of water and related land resources of the Willamette River Basin in Oregon. Appendix 1- one of the functional appendices - relies upon supporting data contained in the 3 supporting appendices, A through C. The present status of navigation in the Basin is studied through existing projects (including deep-draft channels, inland waterways, hazards, traffic, and bridge and utility crossings), commercial and noncommercial facilities, other transportation modes and their impacts upon navigation, and existing problems. Future demand is estimated for both Portland Harbor and inland waterways. Here potential waterborne commerce, commercial facilities, noncommercial use, equipment, and economics are assessed. Lastly, alternative means to satisfy navigation demands are reviewed for each of the three reaches of the Willamette. The report concludes that there is sufficient volume of commerce in bulk commodities that are well adapted to water transport to warrant improvement of the river for navigation. The improvement project considered most worthy would provide for replacement of Willamette Falls Locks with a larger, single-lift facility, and improvement of the channel between Oregon City and Albany. An analysis of the comprehensive plan for water resources with regard to navigation is contained in Appendix M - Plan Formulation. (See also W79-08433) (Zayac-NC)
W79-08442

WILLAMETTE BASIN COMPREHENSIVE STUDY OF WATER AND RELATED LAND RESOURCES: APPENDIX J--POWER.
Pacific Northwest River Basin Commission, Portland, OR. Willamette Basin Task Force.
For primary bibliographic entry see Field 6B.
W79-08443

6E. Water Law and Institutions

ALTERNATIVES FOR GROUND WATER LAW CHANGE IN ARIZONA,
R. B. Fleming, and K. E. Foster.
Water Resources Bulletin, Vol. 15, No. 1, p 198-205, February 1979. 30 ref.

Descriptors: *Groundwater, *Arizona, *Water law, *Alternatives for change, *Water level decline, Legislation, Water rights, Wells, Water Supply, Colorado River, Droughts, Overdraft, Western US, Prior appropriation doctrine, Water resources, Legislative history, Reasonable use.

Western state water resources are drawing increasing attention because of prolonged drought, groundwater overdraft and an ever-increasing awareness of insufficient Colorado River water to supply a growing population and meet industrial demand. Arizona is no exception, and the alarming decline in groundwater levels has prompted the Arizona State Legislature to adopt legislation establishing the Ground-Water Management Study Commission to recommend legislative action by 1979. This paper summarizes Arizona's ground water legislative history and discusses possible alternatives for change. The authors address specific issues facing the state and offer a set of possible Commission recommendations. (Bell Graf-Cornell)
W79-08003

MONTANA'S EXPERIENCE IN RESERVING YELLOWSTONE RIVER WATER FOR INSTREAM BENEFICIAL USES--LEGAL FRAMEWORK,
Bureau of Reclamation, Denver, CO. Water Quality Office.
J. L. Thomas, and D. Klarich.
Water Resources Bulletin, Vol. 15, No. 1, p 60-74, February 1979. 3 tab, 14 ref.

Descriptors: *Montana, *Water law, *Yellowstone River, *Instream use, *Flow reservation applications, Administrative procedures, Irrigation, Standards, Water quality, Dissolved solids, Water Use Act, Water Moratorium Act, Instream requests, Fish and wildlife requirements, Consumptive use requests, Municipalities, Multipurpose requests, Industrial applications, Water-use conflicts, Public hearing, Water depletion.

The Yellowstone River historically has produced an ample supply of high quality water which is widely used for irrigation, municipal and industrial purposes, recreation, and fish and wildlife. Recently, energy companies have attempted to obtain water rights in the Yellowstone basin for energy companies have attempted to obtain water rights in the Yellowstone basin for energy conversion facilities in coal-rich southeastern Montana. Existing users fear that energy diversions will impair their rights, preclude expansion of present beneficial users, degrade water quality, and adversely affect fish and aquatic life. In response to these concerns, the Montana Legislature enacted several laws to regulate water appropriations in the Yellowstone River basin, including means by which state and federal agencies could apply for reservations of water for future beneficial uses. Thereafter, both the Montana Fish and Game Commission and the State Water Quality Bureau formally requested relatively large instream flows to protect fish and wildlife and to maintain water quality. This paper describes Montana's experience through December 1977 with the administration of water in the Yellowstone basin under these laws; emphasis is placed on the major requests for instream flows. (Bell Graf-Cornell)
W79-08007

SOIL SATURATION PROBLEMS ON THE TRUCKEE-CARSON PROJECT, NEVADA,
Nevada State Historical Society, Reno.
J. M. Townley.
Agricultural History, Vol. 52, No. 2, p 280-291, April 1978, 37 ref.

Descriptors: *Drainage programs, *History, *Water policy, *Political constraints, *Institutional constraints, *Land reclamation, Administration, Drainage effects, Drainage engineering, Drainage systems, Governmental interrelations, Water resources development, Irrigation water, Nevada, Seepage, Saturated soils.

One of the 5 original irrigation projects proposed by the Reclamation Service in 1903, the Truckee-Carson Project, in Churchill County, Nevada, is described here to illustrate at project level the problems during the progressive era of merging engineering specialists into bureaucratic form. The importance of proper drainage is a lesson which was well learned by the dirt farmer during the expansion of irrigated farmland in the western states and territories in the latter half of the nineteenth century. It is this question of drainage that is examined in this historical account of two decades of interactions between the Department of Interior and the Truckee-Carson Project to document that decisions supposedly made from sound engineering tabulations were, in reality, based upon political necessity. The drainage system constructed between 1904 when the ground studies were conducted and 1906 when the project first provided irrigation water represented a poor compromise between conscientious groundwater specialists and economy-minded USRS officials. Although the unproductive disputes documented here that ensued over the next two decades ended in 1928 with the completion of a barely adequate drainage system, continuing distrust appears to be a heritage of this earlier time. From actions taken by the Reclamation Service during this 20-year period, it is implied that the technician changes more than the system within which he functions. (Tickes-Arizona)
W79-08022

DISTRIBUTIVE POLITICS RECONSIDERED--THE WISDOM OF THE WESTERN WATER ETHIC IN THE CONTEMPORARY ENERGY CONTEXT,
Arizona Univ., Tucson. Dept. of Political Science.
H. Ingram, and J. R. McCain.
In: New Dimensions to Energy Policy, p 69-77, (1978). Lexington Books, D. C. Heath and Company, Lexington, MA; Toronto. Lawrence, R. Ed., 2 tab. OWRT A-085-ARIZ(1).

Descriptors: *Water policy, *Competing uses, *Water utilization, *Water allocation(Policy), *Institutional constraints, *Water resources development, Planning, Economics, Political aspects, Local governments, Regions, Federal government, Water rights, Energy.

The potential effect of energy development demand for water on the prevailing patterns of water use in the Colorado River Basin is examined with respect to policy-making. If the rich energy resources of the Colorado Basin were to be developed to meet the Nation's demand, 28 to 52% of the available surface water in the upper basin will have to be used. This consumption would result in greater salinity in the Colorado River and decrease the usefulness of the waters for some purposes. People are willing to allocate more of the same amount of water to energy production, but they also want more or the same amount of water for other uses. Westerners still support the traditional concept of federally subsidized water develop-

ment, although the Carter Administration is firmly against Federal investment in construction projects. In focusing on energy development the Federal Government supports subsidizing it, and an expanding Federal water development program to serve energy without depriving water users may no longer be politically feasible. While favoring energy development, people in the Western states are unwilling to endure more air and water pollution and environmental damages for energy produced in their state to be used elsewhere. It is thought that the energy policy-making process is poorly designed in elucidating the implications of energy development in changing patterns of water use and water quality. Energy development costs to the region, including the costs of reallocating water, should be recognized in the policy-making process, and the redistribution of water resources should be based on concerns other than the ability to pay. (Davison-IPA)
W79-08162

SUMMARY REPORT, SOUTHEAST CONFERENCE ON WATER CONSERVATION AND ALTERNATIVE WATER SUPPLIES, GEORGIA INSTITUTE OF TECHNOLOGY, ATLANTA, GA NOVEMBER 8-9, 1978.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-297 982, Price codes: A04 in paper copy, A01 in microfiche. Southeast Water Resources, Vol. 1, No. 2, Spring 1979, 48 p, 16 fig, 4 ref. Water Resources Research Institute, North Carolina University, Raleigh. OWRT B-123-NC (3) and B-125-NC (3).

Descriptors: *Water conservation, *Water resources development, *Planning, *Alternative planning, Alternative water use, Conservation, *Water supply, Water supply development, Water demand, Alabama, Florida, Mississippi, Georgia, North Carolina, South Carolina, Tennessee, Virginia.

Formal papers, verbal presentations and associated discussion from the Southeast Conference on Water Conservation and Alternative Water Supplies are summarized. The conference met to (1) describe present and emerging conflicts for available water supplies arising out of competing demands from cities, industry, agriculture, and instream use; (2) examine alternative new sources of water supply; (3) consider opportunities for extending existing supplies through conservation and more efficient water use; and (4) recommend courses of remedial action to assure adequate supplies of water to meet future needs in the southeast. The conference was organized by the State water resources research institutes and State water resource agencies of the southeast. (Davison-IPA)
W79-08164

THE MISSOURI BASIN REGION'S WATER QUALITY PLANNING STRATEGY PLANNING DOSSIER. SECOND EDITION.
Federal Water Quality Control Administration, Washington, DC.
For primary bibliographic entry see Field 5B.
W79-08174

FARMERS HOME ADMINISTRATION USE OF GRANT FUNDS FOR WATER AND WASTE DISPOSAL SYSTEMS,
General Accounting Office, Washington, DC.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-271 262, Price codes: A03 in paper copy, A01 in microfiche. Report CED-77-109, August 1977, 45 p, 4 appendices.

Descriptors: *Waste water disposal, *Waste disposal, *Waste disposal systems, *Grants, *Projects, *Farmers Home Administration, Government finance, Rural areas.

This report is a crituque of the Farmers Home Administration (FmHA) policy of granting less than authorized amounts for rural water and waste disposal projects. The GAO analyzed all projects receiving grants during fiscal year 1976. The analysis included 650 such projects; of these, 429, or 66%, did not receive the maximum allowable FmHA grant and 22% (143) received more than the maximum allowable grant. However, only 5% would be considered overfunded in terms of authorizing legislation in that the grant for these projects exceeded 50% of eligible project costs. The other 138 projects were evidently overfunded according to Agency regulations but not according to authorizing legislation. The FmHA indicated that its basic goal is to reduce payments to farmers and other rural residents to a reasonable level, and felt that goal had been accomplished. Adjusting grant amounts would create problems and they would oppose such adjustments because: (1) computations were based on mechanical calculation and did not consider funding priorities set by the state; (2) Agency regulations do not require 'maximum allowable grant' to be made in every case; (3) other funding factors affect final determination of grant amounts; (4) the program goals have been accomplished; and (5) adjusting grants for certain recipients could set a precedent difficult to change. Any GAO recommendations for improvement or change will be contained in a subsequent report. (Arnold-NC)
W79-08175

SURVEY OF RIVER BASIN PLANNING TECHNIQUES,
Illinois Inst., of Tech., Chicago.
F. Kudrna, C. Kueltzo, and P. Thomas.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-274 860, Price codes: A02 in paper copy, A01 in microfiche. Illinois Institute for Environmental Quality, Chicago, Report IIEQ 74-48. October 1974. 19 p.

Descriptors: *River basins, *River basin commissions, *Regional planning, *Water resources, *Illinois, Comprehensive planning, Natural resources, Water resources development, Wastewater treatment, Data collection, Survey design, Mathematical models, Computer simulation, Federal water pollution control act, State implementation plans.

This monograph describes efforts to determine what procedures and planning tools were being used by various state agencies to implement the areawide waste treatment management and river basin planning aspects of the 1972 Water Pollution Control Act Amendments (P.L.92-500). The original study attempted to collect data on the ongoing activities in these areas. Illinois and other states could review these data and use the best available techniques and approaches when implementing the river basin planning requirements of P.L.92-500. The legislative interconnections between various planning programs are listed and a description of the study's literature search is offered. The questionnaire used to assess what regional and federal agencies were doing concerning water pollution and river basin planning is described. Examples of survey questions and the federal agencies and river basin commissions to which the questionnaires were sent are listed. A state-by-state review was undertaken and the data received are summarized. It is recommended that all state programs responding to the 1972 Amendments of P.L.92-500 do so in the broadest possible context to facilitate maximum integration of water pollution control programs with other water and land use programs. A broad common data base should be compiled along with development and use of predictive modeling techniques in the related areas of water and land use planning on a regional scale. National dissemination of information is recommended; and a steering committee should be established in Illinois to define the interconnections of the various programs. (Coan-NC)
W79-08177

COMPREHENSIVE WATER QUALITY MANAGEMENT FOR THE STATE OF SOUTH DAKOTA. 303(E) BASIN PLAN FOR THE NIOBRARA RIVER BASIN,
South Dakota Dept. of Environmental Protection, Pierre.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-268 366, Price codes: A05 in paper copy, A01 in microfiche. Report 1976. 79 p. 16 tab, 4 fig, 5 append.

Descriptors: *River basins, *Water resources development, *Water quality standards, *Water pollution sources, *Niobrara River basin(SD), *South Dakota, Water supply, Comprehensive planning, Water pollution control, Municipal wastes, Agricultural wastes, Industrial wastes, Hydrology, Flow, Soils, Antelope Creek(SD), Keya Paha River(SD), Non-point pollution.

This report presents South Dakota's strategy for correcting water pollution and thereby improving and maintaining water quality in the Niobrara River Basin. This basin is relatively long and narrow, occupying portions of three states and draining approximately 13,000 square miles. The population density is low, land development is nearly absent and consequently the basin has some of the highest quality water in the state. This plan specifies the process of planning and managing pollution abatement operations to achieve South Dakota's standards for pollution discharge to, and water quality in, Niobrara River Basin's lakes, rivers, tributaries. General information pertaining to 303(e) plans the statutory authority for planning, an analysis of federal law PL 92-500, and constitutional constraints to basin planning are presented. The report gives an in-depth profile of topography, hydrology, soils, surface water quality standards and classification of stream segments. Both point and nonpoint source pollution is described through inventories of municipal, industrial and agricultural discharges. Recommendations include revision or removal of the iron (Fe) criterion in South Dakota Water Quality Standards; increased cooperation between the U.S. EPA and local agencies; possible revision of the Keya Paha River and Antelope Creek from Water Quality Class segments to Effluent Limitation segments; and possible construction of a single wastewater treatment facility to serve both Mission and Antelope. Appendices present surface water quality standards, and the definition and significance of water quality parameters. (Coan-NC)
W79-08178

WATER NEEDS AND RESOURCES. RATIONAL MANAGEMENT: THE KEY TO THE SUPPLY-DEMAND EQUATION,
United Nations Educational, Scientific and Cultural Organization, Paris (France). Natural Resources and Environmental Sciences.
M. Batisse.
Nature and Resources, Vol. 12, No. 4, p 2-9, October-December, 1976.

Descriptors: *Water demand, *Social aspects, *Water shortage, *Water supply, *Water resources, *International water supply, Water resources management, Economics, Water requirements, Industrial water, Domestic water, Consumptive use, Withdrawal use, Irrigation water, Water pollution, Water resources planning.

This article addresses the relationship between people and their most vital material resource--water. The author warns against considering the 'water crisis' as worldwide because it tends to blur the fact that situations vary considerably from place to place. Broadly speaking, there is a water problem when demand is not matched correctly with supply. The author differentiates water demand into three sectors: domestic or municipal use, agricultural use, and industrial use; he further differentiates between consumptive use, withdrawal use, and in-stream use in each category. The international domestic water supply situation is described as one where the spread of urbanization is overtaxing water supply systems with slums occurring which lack any distribution system. The rural situation may be even worse because of lack of a dependable water supply. Agricultural demand for water arises primarily from irrigation, which requires considerable amounts of water but also renders the land extremely productive. Rapid industrialization is causing increasing use of industrial water, which may reach 80% of total water withdrawal in technologically advanced countries. It will constitute a smaller percent where irrigation competes with industry for water, but industry is more amenable to using lower quality water or recycling water. The author concludes that the world does not face a shortage of water but only a

distribution problem. It is primarily an economic and managerial problem. (Coan-NC)
W79-08182

REUSE OF MUNICIPAL WASTEWATER AND DEVELOPMENT OF NEW TECHNOLOGY--EMPHASIS AND DIRECTION NEEDED.
Comptroller General of the United States, Washington, DC.
For primary bibliographic entry see Field 5D.
W79-08183

REVIEW OF THE PRESIDENT'S JUNE 6, 1978, WATER POLICY MESSAGE.
Comptroller General of the United States, Washington, DC.
Report No. CED-79-2, November 6, 1978. 34 p, 5 append.

Descriptors: *Water policy, *Water quality, *Water resources, *Environmental quality, *Water quality standards, *Water law, *Water management(Administrative), *Groundwater management, Drinking water, Water conservation, Water pollution treatment, Waste treatment, Cost sharing, Stream channelization, Flood control, Water banking, Water supply, Groundwater resources, Federal government.

This report analyzes the implications of President Carter's June 6, 1978 Water Policy Message. Although this report commends the initiatives of the message, it notes that some of the objectives may not be met by those initiatives, namely that proposed reforms for better project cost/benefit determination, integration of water conservation principles into national water policy, and the Administration proposal to change standards to require consideration of nonstructural alternatives to a water project need to be spelled out more specifically to be effectively implemented. The GAO concludes that water policy decisions are dominated by agency self-interest, hampering effective policy making. The GAO commends the cost sharing provision but feels it does not deal adequately with requirement for states to fully justify the need for project funds. Water conservation should be encouraged by modifying assistance and loan programs; groundwater management and conservation should receive greater attention and be encouraged through agricultural assistance programs. Federal/state cooperation in water management should be enhanced. Maintenance and improvement of environmental quality requires more attention to decisions affecting water and related land resources, especially as these relate to wildlife resources, floodplains, wetlands or historic and archeological sites. The GAO concludes that there is a lack of water quality consideration in the message and that more consideration needs to be given to effects of waste disposal on water supply, quality of drinking water, elimination or reduction of nonpoint sources of pollution, recycling and reuse of water, and coordination between water quality and water supply. (Arnold-NC)
W79-08184

RESERVED WATER RIGHTS FOR FEDERAL AND INDIAN RESERVATIONS: A GROWING CONTROVERSY IN NEED OF RESOLUTION.
Comptroller General of the United States, Washington, DC.
Report to the Congress No. CED-78-176, November 16, 1978. 112 p, 8 append.

Descriptors: *Water resources, *Water rights, *Riparian rights, *Federal jurisdiction, Legal aspects, Indian reservations, Federal reservations, Regional planning, Water supply, Legislation, Federal lands.

Increasing competition for limited water resources plus recent severe droughts in the Western United States are signs that a crisis over adequate water supply may be approaching. This report describes the issues and controversies surrounding undetermined Federal and Indian reserved water rights. The report examines the nature of State water rights systems by describing the history of legal issues involved over reserved water rights and defining the two major doctrines relevant to water rights--common law riparian doctrine and appropriation doctrine. The 11 Western states where most Federal and Indian reservation lands are located have major portions of their water resources in these reservations and controversy is growing over the status of these reserved water rights. An analysis of consumptive and withdrawal use in the 11 Western states is accomplished with an analysis of Indian water demands. The report raises many questions over the definition, scope, quantification, and administration of Indian and Federal reserved water rights and compensation for these rights. The effects of reserved water rights controversies are examined in terms of landmark legal cases. Some of these cases are USA and Papago Indian Tribe v. City of Tucson and others, U.S. and Pyramid Lake Paiute Tribe v. Truckee-Carson Irrigation District and others, and Colville Confederated Tribes v. Watton. The report concludes that legislation may be necessary to resolve many of the controversial questions presented here and sends recommendations to Congress. Past and recent proposals to resolve the controversy are outlined and their shortcomings noted. These past legislative proposals consist of the Barrett, Agency, Moss, McCarran and Kiechel Bills. (Coan-NC)
W79-08185

DOMESTIC WATER DELIVERY IN BOISE, IDAHO,
Boise Center for Urban Research, ID.
R. Behling, T. Bohner, S. Brender, A. R. MacMilan, and G. Moncrief.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-278 890, Price codes: A07 in paper copy, A01 in microfiche. Report No. UO-LCCM-BOI-77-015, December 1977. 142 p, 3 append, 29 tab. H-2196R.

Descriptors: *Water delivery, *Water supply, *Water rates, *Municipal water, *Domestic water, *Boise(ID), Water quality, Water consumption, Utilities, Water allocation policy, Population, Bond issues, Investment, Water service, Financial impacts, Franchise agreements.

This report assesses the water distribution system in Boise as to efficiency and cost effectiveness and the possibility of converting ownership of the water supply from private to public bodies. Water in Boise City is now distributed by a multitude of corporations, private companies and wells. The question is raised as to whether this multiple approach is the most efficient and effective, and if not, what alternatives are available. The major tasks of the project are: (1) development of an historical overview of domestic water supplies in Boise; (2) to review present water suppliers and water services; (3) to investigate data available for planning for future domestic water needs; (4) to review legal considerations of city franchise agreements and ownership change; (5) to review the city administration and organization that would be impacted by converting water service to a municipal operation; (6) to review financial considerations of conversion from private to public ownership; (7) to review the experience of municipalities that have acquired domestic water systems. Data on residential, commercial, and industrial water consumption are presented with an analysis of water quality from various supplies. Quality of domestic water is generally adequate and customers are satisfied with present delivery. (Coan-NC)
W79-08186

INTERREGIONAL ADVANTAGES IN BROILER PRODUCTION: THE POTENTIAL IMPACTS OF NAVIGATION USER CHARGES,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Agricultural Economics.
W. Spilka, Jr., D. Kenyon, and L. Shabman.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-298 044, Price codes: A04 in paper copy, A01 in microfiche. Research Division Bulletin 145, November 1978. 35 p, 4 fig, 13 tab, append. OWRT B-082-VA(3).

Descriptors: *Navigation user charges, *Transportation, Transportation model, Marketing, River systems, Poultry.

The objective was to determine what effect the imposition of navigation user charges would have on the geographical location of the broiler industry. A transportation model was developed which incorporated the basic production, consumption, and cost characteristics of the broiler industry. Eight production areas were chosen. Budgets including the costs of assembling, producing, processing, and transporting broilers were formulated for each production area. The model was then evaluated under different production and cost specifications. A least-cost solution indicating production and distribution of broilers was found. Excess production capacity of 1, 3, and 5 percent was then allowed in each production area. A new pattern of production and distribution of broilers was obtained for each capacity level. The solutions indicated that high-cost northern production areas lost market share to low-cost southern producers. These alternative production specifications were then resolved with navigation user charges which recovered all public costs of operation and maintenance of the river systems added to the cost budgets of the southern production areas. The net effect of the largest proposed user charge was calculated. The new solutions indicate in all cases that the proposed maximum user charge would not affect the production and distribution of broilers.
W79-08197

INSTITUTIONAL CONSTRAINTS ON LAND MANAGEMENT FOR WATER RESOURCE PROTECTION IN URBAN AND SUBURBAN WATERSHEDS,
New York Univ., NY. Graduate School of Business Administration.
R. Zimmerman.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-298 271, Price codes: A05 in paper copy, A01 in microfiche. Technical Completion Report, July 1979. 69 p, 17 tab, 5 append. OWRT B-075-NY(1), 14-34-0001-8013.

Descriptors: Urban runoff, Stormwater management, *Land management, Land use, *Institutional constraints, Manpower, Street maintenance, Street cleaning, Snow removal, Catchbasin maintenance, Pesticide management, *Water pollution control, *Non-structural alternatives.

Empirical studies indicate that land management activities contribute to adverse changes in both water quality and natural hydrology. These activities are operations and maintenance functions basic to infrastructure, such as street sanitation and repair, snow removal, maintenance of parks, catchbasins and sewers, and pesticide use. This study provides insights into institutional constraints to land management for avoiding adverse water resource effects. Specifically, research relates to: (1) adaptability of land management functions to new goals; (2) relationship of an inability to establish liaisons with environmental concerns and role perceptions, organizational attributes, and manpower; (3) viability of 'networking' existing agencies for new goals for water resource goal implementation via land management. The method used was an interview questionnaire to 36 officials in 17 localities in the Lower Hudson and secondary data to discern awareness and perception of water resource planning and regulatory programs, personal background and technical procedures. Findings indicate no formal relationship between land management and water resource activities. The little connection existing is informal, nonmandatory and fortuitous, via joint functions or previous jobs. Reliance of manpower on CETA reduces training opportunities in water resources. Professional associations are a potential vehicle for creating liaison functions. In specific functional areas, street cleaning and repair rarely coordinate potentially creating a situation where street cleaning is not effective, and catchbasin maintenance and local ordinances preventing debris do not compensate. Pesticide use among local departments is also not coordinated. Information bases for all land management activities are poor and not adaptable to water resource management needs.
W79-08341

NATIONAL RESIDUALS DISCHARGE INVENTORY: AN ANALYSIS OF THE GENERATION, DISCHARGE, COST OF CONTROL, AND REGIONAL DISTRIBUTION OF LIQUID WASTES TO BE EXPECTED IN ACHIEVING THE REQUIREMENTS OF PUBLIC LAW 92-500,
National Research Council, Washington, DC. Study Committee on Water Quality Policy.
R. A. Luken, D. J. Basta, and E. H. Pechan.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-252 288, Price codes: A11 in paper copy, A01 in microfiche. Report No. NCWQ 75/104. January 1976. 239 p, 18 fig, 66 tab, 65 ref, 7 append.

Descriptors: *Water pollution control, *Water pollution control act, *Pollution abatement, Waste disposal, Sludge disposal, Sludge treatment, Wastes, Water pollution treatment, Abatement, Legislation, Waste treatment, Sewage treatment, Costs, Cost analysis, Liquid wastes.

Work performed by consultants and staff of the Study Committee on Water Quality is described. Areas studied included regional distribution of activities or sources discharging residuals to the waters of the nation; the magnitude of such residuals; reductions expected upon achievement of the technological requirements of the 1972 Act; estimates of the distribution of the costs of achieving the requirements; and some illustrative analyses of policy implications of several alternative policies for achieving the water quality objectives of the 1972 Act. A quantitative assessment of residuals generation and discharge and of the costs of residuals discharge reduction in each of the 3,111 counties in the contiguous U.S. is presented. Compilation techniques, and data sources used are described, and findings are developed on the distribution of the diverse residuals generating activities, the relative effects of best available and best practicable technology on water quality, and the estimated costs of policies other than the imposition of national effluent limitations. (Schaefer-IPA)
W79-08345

STRATEGIES FOR RESERVING FLOWS FOR FISH AND WILDLIFE: IDENTIFICATION, DESCRIPTION, AND PRELIMINARY EVALUATION,
Dewsnup (Richard L.)/Dallin W. Jensen, Salt Lake City, UT.
R. L. Dewsnup, and D. W. Jensen.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-276 243, Price codes: A99 in paper copy, A01 in microfiche. February, 1977, 549 p.

Descriptors: *Western United States, *Water resources, *Regulation, *Stream flow, Water quality, Conservation, Fish, Wildlife, Legal aspects, Federal government, State governments, Ecology.

Strategies available under existing law in 13 western states for reserving fish and wildlife flows are identified, described and evaluated. This study was prompted partly because western appropriation law developed to accommodate diversions from watercourses for economic development, with little consideration to protecting instream values. Consequently, many difficulties were encountered with subsequent efforts to protect instream flows. The instream uses neither: (1) satisfied the appropriation law requirement of a physical diversion from the watercourse nor (2) qualified as a 'beneficial use'. In addition to state strategies, federal strategies under statutes, regulations and programs are discussed. The extent to which interstate compacts may serve to protect or reserve instream flows is evaluated. A summary report contains 25 strategies of the 75 identified, as candidates for further study. There are many citations to statutes, cases and administrative regulations. (Ewing-Florida)
W79-08401

LESSONS FROM A WET STATE,
Conservation Law Foundation of New England, Inc., Boston, MA.
A. Dawson.
In: Proceedings of the National Wetland Protection Symposium, June 6-8, 1977, Reston, Va., U.S. Dept. of the Interior, Washington, D.C., p 185-95, 1978.

Descriptors: *Massachusetts, *Wetlands, *Flood plain zoning, *Flood plains, Water law, Land use, Land management, Zoning, Permits, Property values, Priorities, Environment, Regulation.

For almost 15 years, Massachusetts has rejoiced in a variety of laws designed to protect wetlands and floodplains. This regulatory activity has produced much litigation, and eight cases decided by the Supreme Judicial Court of the Commonwealth Supreme Court. The Massachusetts statutes are the pattern of the laws of many other states; and Massachusetts' legal decisions may be precursors of results in other quickly urbanizing areas. An extensive analysis of Massachusetts Statutes on wetland protection and cases decided under those is presented. Of particular interest is the third decision by the Supreme Court of MacGibbon v. Board of Appeals of Duxbury. 'MacGibbon III' has alarmed environmentalists because it may suggest a conservation backlash against the prior trend of affording greater weight to environmental values. It is impossible to predict the outcome of 'taking issue' cases. The argument most likely to prevail over private rights is the prevention of public hazards. Local zoning is an acceptable way to protect floodplains and wetlands, whether or not statewide statutes exist. Suggested necessary elements of an acceptable ordinance are given. (Coffey-Florida)
W79-08402

BACTERIA CRITERIA,
Environmental Protection Agency, Washington, DC. Div. of Water Quality Standards.
For primary bibliographic entry see Field 5A.
W79-08403

OUTER CONTINENTAL SHELF LANDS ACT AMENDMENTS OF 1977.
Energy and Natural Resources Committee (U.S. Senate), Washington, DC.
Report Senate Comm. on Energy and Natural Resources, Report No. 95-284, 95th Cong., 1st Sess (1977), 228 p.

Descriptors: *Continental shelf, *Oil spills, *Offshore platforms, Fish conservation, Oil pollution, Natural gas, Energy, Environmental effects, Environment, Exploration.

Because of the increasing national need to produce more energy, the 1977 Outer Continental Shelf Lands Act Amendments were enacted. Among the purposes of these amendments are: (1) establishment of policies and procedures for managing the oil and natural gas resources of the Outer Continental Shelf (OCS), with the intent to expedite exploration and development; (2) preservation, protection and development of oil and natural gas ensuring a balance between orderly energy resource development and protection of the human, marine, and coastal environments; (3) encouragement of new technology to minimize risk of environmental damage; (4) minimization or elimination of conflicts between the exploration, development and production of oil and natural gas, and the recovery of other resources such as fish and shellfish; (5) establishment of an oilspill liability fund. This fund would pay for the prompt removal of any oil spilled or discharged as a result of OCS activities, and for any damages to public or private interests caused by such spills; and (6) establishment of a fisherman's Contingency Fund to pay for damages to commercial fishing vessels and gear due to OCD activities. (Coffey-Florida)
W79-08404

SOME LEGAL ASPECTS OF WATER RESOURCES MANAGEMENT,
J. W. Jensen.
Public Administration Review, Vol. 37, No. 5, p 456-62, 1977.

Descriptors: *Water management(Applied), *Riparian rights, *Appropriation, *Water distribution(Applied), Water quality act, Administration, Public rights, Water law, Water rights, Water resources, Water supply.

Some of today's water problems cannot be adequately solved through traditional water management techniques. There must be more efficient water use and more emphasis on improving water management. For the Western states under the appropriation doctrine, the courts were not able to control the controversy between 'first in time, first in right' competing users. There now exists a comprehensive statutory scheme for the administration and management of water resources in every western state. A three-fold approach of appropriation, distribution and adjudication by a 'state engineer' is used. Statutory adjudication procedures have solved the problem of lack of integration of existing rights. All users of a common water body are joined in a single action to define each user's rights. In the east, under the riparian doctrine, riparian owners traditionally were allowed to make reasonable user of the water supply so long as the use did not unreasonably interfere with other riparian owners. Now these states are moving to limit riparian rights and have adopted permit systems to control future water uses. (Corey-Florida)
W79-08405

COASTAL ZONE MANAGEMENT PROGRAM DEVELOPMENT AND APPROVAL REGULATIONS.
Federal Register, Vol. 44, No. 61, p 18590-624, March 28, 1979. 1 fig, 3 tab.

Descriptors: *Coasts, *Water management(Applied), *Federal government, Federal jurisdiction, Regulation, State governments, Coastal plains, Coastal structures, Environmental effects, Environmental control, Waste disposal.

These final regulations reflect the most current and accurate interpretation of program approval requirements of the Office of Coastal Zone Management (OCZM). They revise and supersede the Interim-Final Program Development and Approval Regulations published in the Federal Register on March 1, 1978. The primary purpose of these regulations is to set forth the requirements for state coastal management program approval by the Assistant Administrator for Coastal Zone Management pursuant to the 1972 Coastal Zone Management Act as amended. Included are the grant application procedures for both program development and program implementation funding. Conditions under which grants may be terminated are set forth. The specifics of these requirements are subsumed under the following headings: General Requirements; Uses Subject to Management; Special Management Areas; Boundaries; Authorities and Organization; Coordination; Public Involvement and National Interest; and Miscellaneous. All relevant sections of the Act are dealt with under one of these groupings, but not necessarily in the order in which they appear in the Act. (Coffey-Florida)
W79-08406

INDIAN WATER RIGHTS FOR MINERAL DEVELOPMENT,
P. C. Maxfield, M. F. Dietrich, and F. J. Trelease.
In: Natural Resources Law on American Indian Lands, p 207-238, 1977. Rocky Mountain Mineral Law Foundation, Boulder, Colorado.

Descriptors: *Water rights, *Indian reservations, *Water allocation(Policy), Prior appropriations, Water control, Water policy, Water resources, Water shortage, Water sources, Water supply.

The doctrine of 'reserved water right' for Indians began in 1908 Supreme Court decision of Winters v. United States. The creation of an Indian reservation in a western state also created a water right that would enable the Indians to live on and use the reservation's land. The Indians were given a superior right to water flowing through the reservation over prior water users. The water which had previously irrigated the off-reservation land had to be re-diverted to the Indian land. The Indian water right available for mineral development under the 'Winters Doctrine', may bring seri-

ous conflict with other water users. The state and federal water law background and areas of conflict between them are detailed. The basic theory of the Winters Doctrine and its intended purpose are explained. Which lands and water come within the 'reserved rights' category is discussed. The permitted uses and the quantity of the water use are examined. The transfer of 'reserved rights' to mineral operators and the adjudication of reserved rights are included. (Coffey-Florida)
W79-08407

OFFSHORE LEASING - A SHOWDOWN BETWEEN BIG OIL AND BIG GOVERNMENT,
D. Kirschten.
National Journal, Vol. 9, No. 50, p 1924-28, December 10, 1977, 2 tab.

Descriptors: *Continental shelf, *Oil industry, *Legislation, *Regulation, Legal aspects, Federal government, Environmental effects, Local governments, Drilling, Inter-agency cooperation, Natural resources.

Comprehensive amendments to the 1953 Outer Continental Shelf Lands Acts (OSCLA) are expected to create a showdown between Big Oil and Big Government. At issue is the nation's hunt for new ocean petroleum resources and the management of that quest. The major petroleum firms have lobbied against any changes in the 1953 OCSLA. They contend that new provisions are not needed because of the administrative regulations promulgated under the authority of existing law. The American Petroleum Institute states that the Administration-supported bill should be defeated because it would permit direct federal government involvement in wildcat drilling for offshore oil and gas. This would open the door to the creation of a Federal Oil and Gas Corporation. Actually, the pending legislation simply provides several options for pre-lease test drilling into the geological structures that are likely repositories of offshore petroleum resources. The pending OCSLA amendments also attempt to address concerns of coastal communities which may be affected by offshore oil drilling. Despite the rough seas that the OCSLA reforms have encountered, backers of the bill express confidence that their bill will be passed. (Ewing-Florida)
W79-08408

FINANCIAL RESPONSIBILITY FOR WATER POLLUTION-OUTER CONTINENTAL SHELF (FINAL RULE).
Federal Maritime Commission, Washington, DC.
Federal Register, Vol. 44, No. 53, p 16918-32, March 20, 1979.

Descriptors: *Water pollution, *Oil spills, *Continental shelf, Oil, Oil pollution, Oil industry, Regulation, Transportation, Federal government.

The Federal Maritime Commission issued regulations affecting persons who own and operate vessels carrying oil from offshore facilities over the Outer Continental Shelf. The 1978 Outer Continental Shelf Lands Act Amendments imposes upon such vessel owners and operators a new liability for damages and removal costs resulting from oil discharges. Vessel-operators must demonstrate their financial capability of meeting such potential liability up to certain limits, before their vessels may lawfully engage in any segment of oil transportation from an offshore facility above the Outer Continental Shelf. These regulations set forth the manner by which Financial responsibility can be demonstrated to the Commission. They provide for the issuance of Certificates of Financial Responsibility which must be carried aboard vessels and presented upon request to officials or designees of the U.S. Coast Guard. Vessels having on board Outer Continental Shelf produced oil, which has been brought ashore or loaded as a result of oil spill removal operations, are not subject to these regulations. (Coffey-Florida)
W79-08409

OFFSHORE OIL POLLUTION COMPENSATION FUND AND CLAIMS PROCEDURES (FINAL RULES).
Coast Guard, Washington, DC.
Federal Register, Vol. 44, No. 54, p 16860-77, March 19, 1979.

Descriptors: *Water pollution control, *Oil spills, *Continental shelf, Oil, Oil pollution, Oil industry, Regulation, Water quality, Water pollution.

These final regulations are required to implement the recently enacted Offshore Oil Pollution Compensation Fund. This fund is available for certain removal costs and damages caused by oil pollution from Outer Continental Shelf (OCS) activities. The regulations are intended to convey the policies, uniform procedures, and administrative practices regarding the overall management and general operation of the fund. Part 135-Offshore Oil Pollution Compensation Fund-prescribes the policies, procedures, and administrative practices regarding offshore oil pollution liability and compensation, including the administration and general operation of the fund established under Title III of the 1978 Outer Continental Shelf Lands Act Amendments (OCSLA). Part 136-Offshore Oil Pollution Compensation Fund Claims Procedures-prescribes uniform procedures and standards for the settlement of claims against the Fund for economic loss, including removal costs resulting from or arising out of oil pollution from certain OCS activities as authorized by and in accordance with Title III of the OCSLA. (Coffey-Florida)
W79-08410

OIL AND GAS EXTRACTION POINT SOURCE CATEGORY EFFLUENT GUIDELINES AND STANDARDS (FINAL AND INTERIM FINAL RULES).
Environmental Protection Agency, Washington, DC.
Federal Register, Vol. 44, No. 73, p 22069-78, April 13, 1979.

Descriptors: *Pollutant identification, *Pollution abatement, *Oil pollution, Regulation, Federal government, Control systems, Offshore platforms, Agricultural watersheds, Coasts, Water utilization, Industrial water.

Final effluent limitation guidelines establishing 'best practicable control technology currently available' (BPT) are promulgated. These guidelines are for offshore, onshore, coastal and agricultural and wildlife water use subcategories in the oil and gas extraction industry. These final regulations combine the near and far offshore subcategories into a single offshore subcategory. The 'beneficial use' subcategory is renamed the 'agricultural and wildlife water use' subcategory. The definition of the stripper subcategory is clarified. The federal Environmental Protection Agency does not yet have sufficient technical data to promulgate effluent limitations for the stripper subcategory. These sections remain reserved. There are interim final rule changes in the descriptions and applicability of the coastal and agricultural and wildlife water use subcategories. Comments on these interim final changes are solicited. The limitation guidelines are based upon the application of BPT as defined in section 304 (b) of the 1977 Clean Water Act. The effective date was April 13, 1979. (Coffey-Florida)
W79-08411

PUBLIC PARTICIPATION IN PROGRAMS UNDER THE RESOURCE CONSERVATION AND RECOVERY ACT, THE SAFE DRINKING WATER ACT AND THE CLEAN WATER ACT.
Environmental Protection Agency, Washington, DC.
Federal Register, Vol. 44, No. 34, p 10286-97, February 16, 1979.

Descriptors: *Public access, *Solid wastes, *Decision-making, *Pollution abatement, Federal government, Administrative agencies, Adoption of practices, State government, Administrative decisions, Regulation.

These regulations are intended to encourage, provide for, and assist public participation under the Resource Conservation and Recovery Act, the Safe Drinking Water Act, and the Clean Water Act. They replace existing regulations for public participation in solid waste management. 'The Public' in the broadest sense means the general populace. The regulations include general provisions which require open government processes and efforts to promote public awareness of the decision-making process as to programs and activities under the three Acts. Requirements applicable to specific public participation mechanisms, such as, public hearings and advisory groups are included. These regulations do not require the use of the specific mechanisms. The mechanisms must be used only if required in program regulations. The regulations are also designed to ensure government responsiveness to and awareness of public concerns. (Coffey-Florida)
W79-08412

THE CLEAN WATER ACT OF 1977,
J. W. Raisch.
Colorado Lawyer, Vol. 7, No. 4, p 536-49, 1978.

Descriptors: *Colorado, *Federal water pollution control act, *Industrial waste, Environmental control, Toxins, Water quality control, Water quality standards, Waste treatment, Water pollution control, Water pollution treatment.

In December, 1977 Congress enacted amendments to the Federal Water Pollution Control Act (FWPCA). While the amendments contain significant changes or additions to the FWPCA, they do not change the basic statutory scheme set forth in the amendments enacted in 1972 by PL 92-500. The amendments that may be of significance to Colorado lawyers dealing with water pollution control are discussed. Compliance deadline extensions to July 1, 1983 have been provided in the areas of industrial point sources and municipal services for such reasons as lack of federal funds. The amendments changed 'best available technology' for industrial sources to a new standard called 'best conventional pollutant control technology'. Changes were made to the toxic pretreatment requirements and to best management practices for industry. These could significantly affect the mining industry in Colorado. As to dredge and fill permits, the Army Corp of Engineer's authority was changed and some exemptions were provided for activities such as congressionally authorized federal projects. Other changes discussed are areawide waste treatment management, water rights and irrigation return flows, and grants for treatment works construction. (Corey-Florida)
W79-08413

THE LAW OF THE SEA: RETHINKING U.S. INTERESTS,
R. Darman.
Foreign Affairs, Vol. 56, No. 2, p 373-95, January 1978.

Descriptors: *Law of the sea, *International waters, *Treaties, *United States, Research priorities, Taxes, United Nations, Foreign countries, Foreign waters, Conferences, Deep water.

Evaluated are the status of negotiations in the Law of the Sea Conference, the past United States' negotiating policy, and the changes which are necessary in United States' negotiating tactics. Earlier emphasis placed on national security and efforts to stem 'creeping jurisdiction' or foreign states is criticized. The deep seabed provisions of the Informal Composite Negotiating Text have been termed fundamentally unacceptable by the United States. Why this was a good decision from tactical and substantive standpoints is discussed. Three adjustments in negotiating tactics are suggested: (1) The United States should exhibit a willingness to accept Conference failure as a non-disastrous, thoroughly tolerable, outcome; (2) It should deliberately seek to breakdown polarization between the developed and developing nations. This is not to be accomplished by concession, but by greater practical attention to, and argument on behalf of, interests that cut across these lines; (3) As a hedge against conference failure and incitement toward success, it should proceed with the development of a 'mini-treaty' outside the conference framework. (Walker-Florida)

W79-08414

A CONFERENCE OF THE MINERAL ESTATE INCLUDES A TRANSFER OF GEOTHERMAL RESOURCES,
S. C. Suklett.
Tulsa Law Journal, Vol. 13, No. 4, p 856-63, 1978.

Descriptors: *Water rights, *Geothermal studies, *Mining, Water law, Natural resources, Energy, Subsurface flow, Subsurface waters, Geysers, Water temperature.

The United States has become increasingly aware of its diminishing fossil fuel resources. One alternative energy source of increasing importance is geothermal energy. In Geothermal Kenetics, Inc. v. Union Oil Co., a California court held 'that the grant of mineral in, on or under the property includes a grant of geothermal resources, and the steam therefrom'. In Reich v. Commissioner, the Tax Court found that geothermal steam developers could use depletion allowance provided by Internal Revenue Code because steam was both a valuable resource and a gas. In United States v. Union Oil Co., the Ninth Circuit Court concluded that geothermal resources were within the meaning of the mineral reservation in the Stock-Raising Homestead Act. The problems created by treating geothermal water as a mineral, may be far more troublesome when other types of geothermal systems are involved. For example in a hot water system there may be an interchange between the geothermal and subsurface water. By requiring water rights to be conveyed separately from geothermal exploitation rights, some progress may be made toward solving problems from geothermal water withdrawal. (Fortin-Florida)
W79-08415

WATER AND WATERCOURSES - RECREATIONAL RIGHTS - A DETERMINATION OF THE PUBLIC STATUS OF WEST VIRGINIA STREAMS,
G. Castelle.
West Virginia Law Review, Vol. 80, Nos. 2-3, p 356-368, Winter, 1978.

Descriptors: *West Virginia, *Watercourses(Legal aspects), *Recreation facilities, *Recreation demands, Common law, Streams, Transportation, Public rights, Public access, Recreation, Water law.

At the turn of the century, the West Virginia streams provided the transportation network for a flourishing lumber industry. Although the streams are no longer so used, a stream's capacity to sustain logging activity survives as the common law test to determine the state's public waters. Since the public waters test was designed to accommodate bygone commercial practices it is ill-suited to a determination of present recreational rights. The development of the West Virginia public waters test is presented. An analysis of federal and state approaches is given. As the public needs changed, so too has the public water test. Now the need has again shifted from commercial traffic to recreational uses. The public waters test need change accordingly. Underlying the public waters issue is a determination of whether the state definitions are principally designed to provide for public commerce or public use. If the definition of Public Waters is designed to provide for public use, then the public waters test must be modified so that present rights reflect present conditions. (Coffey-Florida)
W79-08416

PUBLIC ACCESS TO OCEAN BEACHES: IF YOU FIND A PARKING SPACE, HOW DO YOU GET TO THE BEACH,
North Carolina Univ. at Chapel Hill. Urban and Regional Studies Center.
D. Brower, and W. Dreyfoos.
Coastal Zone Management Journal, Vol. 5, No. 1/2, p 61-81, 1979.

Descriptors: *Public access, *Beaches, *Recreation facilities, Land use, Recreation, State governments, Legislation, Federal government, Eminent domain, Easements, Prescriptive rights.

Beach and ocean recreational resources cannot be enjoyed and appreciated unless government finds ways to guarantee passage to those beaches. As more of out privately-owned beachlands are developed and the public are kept out, government must find ways to ensure continued public access where it already exists, and develop new access ways. A variety of means for increasing public access are suggested: (1) state legislation; (2) purchases of fee-simple title; (3) purchases of easements; (4) prescriptive easements; (5) eminent domain; (6) dedication; (7) trades; (8) after hurricane acquisitions; (9) land-use controls; and (10) federal programs. Governments are more likely to look to these tools as federal funds increase for coastal zone management. Should federal funding not materialize, state and local governments should plan for and acquire increased public beach access. National and state coastal recreational planning and management agencies should strive for expanding opportunities for public beach use, with increased public access as the first step. Included are 57 references. (Coffey-Florida)
W79-08417

THE CONFLICT OVER THE NEW RIVER AND THE TEST CASE FOR THE WILD AND SCENIC RIVERS ACT (COMMENT ON NORTH CAROLINA V. FPC),
North Carolina Central Univ., Durham.
E. DiSanto.
North Carolina Central Law Journal, Vol. 9, No. 2, p 192-207, 1978.

Descriptors: *Wild rivers, *North Carolina, *Administrative agencies, *New River, Rivers, Federal power act, Political aspects, Legislation, Judicial decisions, Water resources, Environmental control.

The evolution of the controversy surrounding the New River is traced. The long-awaited test case for the Wild and Scenic Rivers Act (WSRA), North Carolina v. FPC is examined. The effects of the District of Columbia Circuit Court's interpretation of this Act are: (1) an unjustifiable limitation on the individual states ability to safeguard unique rivers; (2) a failure to impose statutorily mandated burdens on the Federal Power Commission (FPC); (3) a frustration of the Congressional intent to create an autonomous statutory mechanism for environmental protection; (4) inevitable ad hoc protective legislation; and (5) a failure to consider the interrelationships of the statutory provisions of the WSRA, the National Environmental Policy Act (NEPA), and the Federal Power Act. In light of the New River Case, this interrelationship is examined. A statutory framework of accommodations is proposed. Through the NEPA, Congress intended to create an integrated autonomous structure for environmental protection. The Circuit Courts decision undermines this structural integration by eliminating local discretion. Similarly, the FPC action undermine the NEPA objectives, as they failed to adequately assess all environmental alternatives. Departure from the structural approach of NEPA subjects environmental planning and decision-making to the happenstance. (Fortin-Florida)
W79-08418

STATEHOOD AND THE EQUAL FOOTING DOCTRINE: THE CASE FOR PUERTO RICAN SEABED RIGHTS.
Yale Law Journal, Vol. 88, No. 4, p 825-49, March 1979.

Descriptors: *Puerto Rico, *Federal-state water rights conflicts, *Continental shelf, Constitutional law, Political constraints, Federal government, Political aspects, State government, State jurisdiction, Resources, Water law.

Soon, negotiations between Puerto Rico and the United States will probably explore statehood as an alternative to the island's current commonwealth status. Political pressures for Puerto Rican demands for exclusive rights to exploit its surrounding seabed will probably meet with opposition based on the 'equal footing doctrine (doctrine)'. That doctrine prevents extension of a state's sovereignty into the domain of the United States' political and sovereign power from which other states have been excluded. A new historical analysis of the doctrine is presented demonstrating that the doctrine poses no barrier to such an extensive seabed grant upon Puerto Rico's admission into the Union. The submerged lands issues left unsettled by the case law are defined. A framework is derived for the doctrine from a historical analysis of submerged lands and equal footing cases. This framework is applied to Puerto Rico's claims. How Congress may cede seabed rights to the island on admission is demonstrated. The language and limitations of such an agreement are considered. (Coffey-Florida)
W79-08419

THE CLEAN WATER ACT OF 1977: GREAT EXPECTATIONS UNREALIZED,
M. J. Miars.
Cincinnati Law Review, Vol. 47, No. 2, p 259-71, 1978.

Descriptors: *Water pollution control, *Federal water pollution control act, *Cost-benefit analysis, Environmental control, Costs, Cleaning, Pollution abatement, Political constraints, Legislation, Industries.

On December 27, 1977, President Carter signed into law the 1977 Clean Water Act. The signing marked the end of a two-year struggle over adjustments to the Federal Water Pollution Control Act (FWPCA). Although certain groups were disappointed by the 1977 modifications, both industry and environmentalists generally were pleased with the viable compromise that emerged. Selected 1977 FWPCA amendments are examined for their future effectiveness. A brief history of water pollution control in the United States is included. A brief analysis is presented of the 1899 Refuse Act, the 1948, 1956, 1961, 1972 and 1977 Federal Water Pollution Control Act, 1965 Federal Water Quality Act and The 1966 Clean Water Restoration Act. Industry and environmentalist reaction to the 1977 amendments to the 1972 Clean Water Act are also discussed. The benefits of water pollution control must be evaluated in light of a normative policy. The long-term advantages of an enhanced quality of living must be recognized without focusing solely on an ever-increasing material lifestyle. (Coffey-Florida)
W79-08420

THE CLEAN WATER ACT OF 1977: MID-COURSE CORRECTIONS IN THE SECTION 404 PROGRAM,
J. R. Curtiss.
Nebraska Law Review, Vol. 57, No. 4, p 1092-1112, 1978.

Descriptors: *Federal water pollution control act, *Navigable waters, *Pollution abatement, Political aspects, Water pollution control, Water pollution sources, Political constraints, River and harbors act, Dredging, Jurisdiction.

Congress enacted the 1972 Federal Water Pollution Control Act (FWPCA) intending to restore and maintain the chemical, physical, and biological integrity of the nation's waters. The likelihood of success is in large part dependent upon the section 404 dredge and fill program. The precise nature and extent of Army Corps of Engineers jurisdiction under section 404, has been a subject of continuing controversy. A conflict has existed between the congressional intent to expand the definition of navigable waters under the FWPCA and the Corps' continuing committment to a limited jurisdiction. This prompted Congress to reexamine the section 404 provisions. In adopting the 1977 amendments, Congress made a number of crucial changes in the dredge and fill program as it existed under the FWPCA. Foremost among these was the decision to retain the road jurisdictional approach in regulating dredge and fill activities, although the manner of control was substantially altered. The amendments provide for state implementation of the permit program for all navigable waters within a state's jurisdiction. (Fortin-Florida)
W79-08421

YUGOSLAV LAW ON MARITIME, INLAND NAVIGATION,
Joint Publications Research Service, Arlington, VA.
Available from the National Technical Information Service, Springfield, VA 22161 as JPRS 69819, Price codes: A14 in paper copy, A01 in microfiche. September, 1977, 308 p.

Descriptors: *Law of the sea, *Navigation, *International water, *Foreign countries, Regulation, Inland waterways, Ships, Boating regulations, Port authorities, International law, Water law.

This law of the Socialist Federal Republic of Yugoslavia regulates the following: (1) the basic safety elements of navigation on the sea and inland waters of Yugoslavia; (2) safety of navigation on waterways in the coastal sea and inland waters of Yugoslavia over which the international or intergovernmental rules prevail; (3) basic legal relations concerning vessels as property; (4) contractual and other binding relations pertaining to vessels; and (5) procedures relating to ship registration, limitations of water carriers, liquidation of general average losses, and execution and attachment of ships as security. The provisions of this law apply to: (1) maritime vessels and inland vessels which have Yugoslav nationality; (2) navigation in the coastal sea and inland waters of Yugoslavia; and (3) the relations which arise in connection with that navigation, unless the law states otherwise. (Vloedman-Florida)
W79-08423

WATER QUALITY STANDARDS, NAVIGABLE WATERS OF THE STATE OF MISSISSIPPI (FINAL RULE),
Environmental Protection Agency, Washington, DC.
Federal Register, Vol. 44, No. 84, p 25223-28, April 30, 1979.

Descriptors: *Mississippi, *Water quality standards, *Dissolved oxygen, *Navigable waters, Water quality, Water quality control, Water uses, Regulations, Federal government, Surface waters, Water law, Pollution abatement.

The federal Environmental Protection Agency (EPA) has promulgated a final rule establishing a dissolved oxygen criterion for all water uses recognized by Mississippi. This criterion is less stringent than originally proposed by EPA because testimony and data submitted at the public hearings and otherwise available to EPA indicated that a balanced aquatic organism population can be maintained at this criterion level in Mississippi waters. The proposed rule would have required all Mississippi surface waters to achieve a minimum dissolved oxygen concentration of 5.0 mg/1. The final rule amends that proposed rule by replacing the phrase, 'at a daily average of not less than 5.0 mg/1 with a daily instantaneous minimum of not less than 4.0 mg/1.' The criterion should be applied under the conditions contained in Section I of the State's standards. Wasteload allocations must be performed to achieve the dissolved oxygen criterion. This rule was effective May 30, 1979. (Coffey-Florida)
W79-08424

TEMPERATURE (TEMPERATURE STANDARDS FOR NATIONWIDE WATER QUALITY MANAGEMENT).
Environmental Protection Agency, Washington, DC. Div. of Water Quality Standards.
For primary bibliographic entry see Field 4C.
W79-08425

CONGRESS MAKES WAVES OVER CARTER'S WATER POLICY,
D. Kirschten.
National Journal, Vol. 10, No. 26, p 1052-56, July 1, 1978.

Descriptors: *Water policy, *Federal government, *Federal budget, Legislation, Cost-benefit analysis, Natural resources, Water conservation, Estimated costs, Regional analysis, Legal aspects.

President Carter is ready to resume the building of new projects to harness the nation's water resources. He has sent Congress a list of jobs which involve harbor improvements, flood protection measures, a new hydropower unit, and rehabilitation work for western irrigation and water supply systems. Congress, by tradition, has had little concern with White House desires about water projects. Congress views this area as particularly its domain. The Administration's differences with Congress go well beyond budgetary questions. Carter's proposals emphasized expenditures to promote water conservation and acquire flood-prone lands, rather than the building of structures to protect them. Among the projects approved by the House, there is a much heavier emphasis on structural solutions and assistance to the barge industry. In order to make the best use of limited budgetary resources, the Administration has weighed water projects against standards designed to stress a realistic evaluation of the economical and environmental costs and benefits. The final question remains. Who, the President or Congress, will have the last word as to whether the criteria have been met. (Ewing-Florida)
W79-08426

GOVERNORS SEEK A WATER POLICY THAT HAS SOMETHING FOR EVERYONE,
D. Kirschten.
National Journal, Vol. 10, No. 11, p 432-35, March 18, 1978.

Descriptors: *Water policy, *State governments, *Federal government, Federal budget, Conservation, Regional economics, Regional analysis, Water supply, Water requirements, Water demand.

As the Carter Administration ponders its next step to cut off federal subsidies that encourage wasteful water uses, the nation's governors have united to urge that federal water funds be more widely disbursed. The governors are seeking a stronger role in water resource decisions. They want to assure that any national water policy will maintain the economic health of each of their regions. Their strategy has been to side-step regional rivalries and unite behind a common framework. If the President's objectives were simply to save water, he would agree with much in the governor's statement of principles, which includes a strong commitment to water conservation and other Carter-proposed reforms. Carter does not so much consider water an endangered resource as he does federal tax dollars. The governors share Carter's recognition that future spending on water projects must be planned carefully, with greater attention given to cheaper alternatives. However, they think planning - subject to federal criteria - should be performed at the state level. (Ewing-Florida)
W79-08427

MIXING ZONES (RECOMMENDATIONS FOR A NATIONWIDE STRATEGY FOR WATER QUALITY MANAGEMENT).
Environmental Protection Agency, Washington, DC. Div. of Water Quality Standards.
For primary bibliographic entry see Field 5A.
W79-08428

WETLANDS PROTECTION EFFORTS, NEEDS AND PRIORITIES IN WISCONSIN,
Wisconsin Univ.-Madison.
B. Bedford.
In: Proceedings of the National Wetlands Protection Symposium, June 6-8, 1977, Reston, Va., U.S. Dept. of the Interior, Washington, D.C., p 63-68, 1978, 7 ref.

Descriptors: *Wisconsin, *Wetlands, *Priorities, Regulation, Ecosystems, Agriculture, Environment, Navigable waters, High water mark, Drainage programs, Zoning, Protection.

Wisconsin's original wetland endowment approached 10 million acres. Somewhat less than 2.5 million acres remain as functioning wetlands. Many of these are significantly degraded. Wetland protection in Wisconsin has resulted from the relationship of wetlands to navigable water bodies. The relationship brings some wetlands within the domain of the public trust and the State Shoreland Zoning Program. The domain of Public Trust Doctrine and navigable waters in Wisconsin are analyzed. The State determines the limits of its regulatory authority in navigable waters on the ordinary high water mark (OHWM). There is an overview of the efforts to protect wetlands through the courts and the regulatory process. A rigorous and critical review of state and federal subsidies to wetland drainage should be undertaken. An active, aggressive and consistent enforcement program of existing wetland laws is needed, especially as to Wisconsin's Public Trust doctrine & Shoreland Zoning Program. (Coffey-Florida)
W79-08429

COASTAL ZONE MANAGEMENT AND PLANNING IN CALIFORNIA: STRATEGIES FOR BALANCING CONSERVATION AND DEVELOPMENT,
J. M. Davidson.
Urban Law Annual, Vol. 15, p 253-79, 1978.

Descriptors: *California, *Coasts, *Shore protection, *Future planning(Projected), Seashores, Legal aspects, Conservation, Natural resources, Legislation, Public rights, Judicial decisions, Management, Planning.

The need for new mechanisms of allocating shoreline resources is underscored by the continued pressure of population and urban growth in coastal regions, and the rapid conversion of estuarine areas to developmental uses. In California, an innovative coastal management strategy has been operative on a regional scale since 1965, and for the entire California coast since 1972. The California coastal program is currently in transition between state interim controls and a predominantly local planning and management system. As the regional commissions are phased out, the permanent local-state system should develop more explicit criteria for balancing conservation and development interests. The California coastal zone management approach may serve as a model for other state programs. The planning and management policies of the 1976 California Coastal Act are the guiding force behind California's present program. The policies establish objectives and priorities for land and water use within the coastal zone without specifying particular uses for individual parcels. By ranking uses according to established priorities without specifying land and water allocations, California avoids challenges and inflexibilities that can emerge from a direct coastal master plan. (Ewing-Florida)
W79-08430

BASES FOR THE LEGAL ESTABLISHMENT OF A PUBLIC RIGHT OF RECREATION IN UTAH'S 'NON-NAVIGABLE' WATERS,
R. Kruth.
Journal of Contemporary Law, Vol. 5, No. 1, p 95-110, Winter, 1978.

Descriptors: *Utah, *Public rights, *Non-navigable waters, *Recreation facilities, Population, Water resources, Prior appropriation, Riaprian rights, Public access, Water law, Streams, Legal aspects.

Since World War II, the dramatic growth in population, amounts of leisure time, and the tourism industry has placed great demands on Utah's water resources and recreational facilities. In Utah, the public's right to use the surface overlying a privately-owned stream bed has remained largely undefined. Various methods by which disputes over surface use rights have been settled in the public's interest are examined. How the same result could be realized within existing Utah law is presented. Ample opportunities exist in Utah law for the establishment of a public right to use non-navigable waters. The best approach is one based on public ownership of water and the usufructuary nature of Utah's water rights. This theory would serve to recognize and confirm public rights in the maximum amount of water suitable for recreation without tying the public right to outmoded notions of navigability. This theory is used in several neighboring states of similar situations and fits well

within the doctrine of prior right of appropriation. (Coffey-Florida)
W79-08431

THE CHANGING WATER MARKET FOR ENERGY PRODUCTION,
McGeorge School of Law, Sacramento, CA.
F. Trelease.
Journal of Contemporary Law, Vol. 5, No. 1, p 83-93, Winter 1978.

Descriptors: *Economic efficiency, *Energy, *Economic feasibility, Economics, Coal mines, Cost analysis, Cost allocation, Water utilization, Water zoning, Prior appropriation, Political constraints.

The legal arrangements for water use should parallel the economic structure to enable and facilitate changes in the water market. Water law should provide for maximum use benefits by granting private water rights. This private grant should be secure enough to encourage development and flexible enough to allow economic forces to change the grant to better uses. These rights should be subject to public regulation only when private economic action fails to protect the public interest. Unfortunately, the market in water rights works very poorly. The political and economic difficulties in shifting a water resource from a lower to a higher productive use in the market is analyzed. Specific attention is given to the need to shift from agricultural uses to coal industrial uses in some western states. The 'spillover' costs in any water rights transfer are considered. Only when everyone affected by transfer 'spillover' costs is brought into the negotiations will equity be achieved. (Coffey-Florida)
W79-08432

PRINCIPLES FOR LOCAL ENVIRONMENTAL MANAGEMENT,
P. G. Rowe, J. Mixon, B. A. Smith, J. B. Blackburn, Jr., and G. L. Callaway.
Ballinger Publishing Company, Cambridge, Massachusetts, 1977. 272 p, 10 fig, 10 tab. ENV 73-07880 A02.

Descriptors: *Local government, *Community development, *Rural areas, *Economic impact, Economics, Governmental interrelations, Management, Alternative planning, Ecology, Population, Natural resources.

Governmental environmental initiatives are carried out by a complex management system that incorporates federal, state and local governments. Appropriate levels of local government responsibility for environmental management and available courses of action are described. A potential shape of future involvement of local government in the overall environmental management process is suggested. Generally focused upon are natural resource consumption, pollution issues and other environmental impacts that impair environmental quality and affect the continuing process of community development. Special attention is given to development in rural areas on the urban fringes where for the first time in United States history, population is growing faster than in metropolitan areas. There are eight chapters: Chapter (1) is an introduction; (2) examines the social costs of environmental management; (3) looks at environmental management from an ecological view; (4) discusses the evolution of public sector activity in environmental management; (5) is on recent environmental laws; (6) includes institutional arrangements; (7) local responses to current legislative requirements; and (8) summarizes the major conclusions and suggests the alternative futures available to local governments in reconciling human purposes and environmental realities. An extensive bibliography is included. (Coffey-Florida)
W79-08467

WATER POLLUTION CONTROL (ASSESSING THE IMPACTS AND COSTS OF ENVIRONMENTAL STANDARDS),
R. A. Luken, and E. Pechan.
Praeger Publishers, New York, 1977. 180 p, 13 fig, 48 tab, 3 append.

Descriptors: *Water pollution control, *Cost analysis, *Federal water pollution control act, Industries, Municipal wastes, Water quality, River basins, Regional analysis, Environment, Water law, Pollution abatement.

Increasing public concern over environmental degradation caused by unchecked water pollution has resulted in a trend toward an increasing federal government responsibility. One of the key policy changes enacted into law by Congress in 1972 is addressed - that of requiring certain categories of industries and municipalities to meet pollution discharge standards based on specific technology objectives regardless of the prior conditions or desired uses of the water. This policy change is examined in four ways: (1) the design of a conceptual approach to provide quantitative information based on available information; (2) use of the tools of quantitative analysis to examine both current policies and some logical alternatives; (3) analysis of the quantitative results to generate findings and conclusions; and (4) consideration of the findings and conclusions to gain insights into potential alternatives that are both more efficient than current policies and more feasibly implemented. Specific recommendations for changes in federal water pollution legislation are presented. (Coffey-Florida)
W79-08468

IMPLEMENTATION OF EXECUTIVE ORDERS 11988 (FLOODPLAIN MANAGEMENT) AND 11990 (PROTECTION OF WETLANDS),
International Boundary and Water Commission, El Paso, TX.
F. P. Fullerton.
Federal Register, Vol. 43, No. 136, p 30494-30495, Friday, July 14, 1978.

Descriptors: *Flood plains, *Wetlands, *Protection, *Legal aspects, United States.

The proposed procedures prescribes policies utilized or to be utilized by the United States Section, International Boundary and Water Commission, in implementing Executive Orders 11988 and 11990 as they pertain to the planning, design and construction of treaty projects along the United States-Mexican boundary and to the United States Section's operation and maintenance activities. (Stihler-Mass)
W79-08498

6F. Nonstructural Alternatives

FLOOD STUDIES LED TO NATIONAL FLOOD INSURANCE,
Geological Survey, Reston, VA. Water Resources Div.
G. W. Edelen, Jr., G. E. Ferguson, and W. B. Langbein.
Civil Engineering-ASCE, p 89-91, February 1979. 2 fig.

Descriptors: *Flood plains, *Flood plain zoning, *Flood plain insurance, Flood protection, Historic floods, Flood data, *Flood plan regulations, *Flood plain management, Federal Flood Insurance Act of 1956, Flood Protection Act of 1973.

The role of flood data in shaping the policies leading to the present flood-insurance program is outlined. Continued improvement in the range of flood information since the U.S. Geological Survey documented the occurrence and progress of the Passaic, New Jersey, flood in 1902 has been the essential key to changing public policy in efforts to cope with the ever increasing flood hazard. Initially, historic records of the magnitude of floods enabled engineers to design and construct works for flood protection. Longer flood records from an expanded network of streamflow stations provided a data base on which to develop flood-frequency relations and to identify an upper limit to actual flood experience. During the 1950's, a new approach centered on adapting flood-prone land use to the flood hazard. Flood-plain regulations became nonstructural alternatives to flood control works. Geological Survey engineers established that streamflow records were adequate and hydrologic techniques were sufficiently developed to provide a base for sound analysis of flood insurance risks. The Flood Protection Act of 1973 increased the limits of flood-insurance coverage and provided for speedier definition of flood-risk zones. (Woodard-USGS)
W79-08199

LESSONS FROM A WET STATE,
Conservation Law Foundation of New England, Inc., Boston, MA.
For primary bibliographic entry see Field 6E.
W79-08402

WILLAMETTE BASIN COMPREHENSIVE STUDY OF WATER AND RELATED LAND RESOURCES: APPENDIX E--FLOOD CONTROL.
Pacific Northwest River Basins Commission, Portland, OR. Willamette Basin Task Force.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A036 757, Price codes: A09 in paper copy, A01 in microfiche. Chaired by the U.S. Corps of Engineers, 1969, 140 p, 2 addenda, 18 tab, 15 fig, 9 maps, 26 photos.

Descriptors: *Flood control, *Non-structural alternatives, *Flood damage, *Flood protection, *River basin development, *Willamette River(OR), *Structural alternatives, Oregon, Water resources, Abatement, Channel improvement, Design flood, Flood forecasting, Flood plains, Construction, Floodproofing, Levees, Channel improvement, Warning systems, Flood storage reduction, Watershed management, Water policy, Flood plain zoning, Regulation, River basins, Management, Flood plain management.

This study was undertaken to plan for the proper development of water and related land resources of the Willamette River Basin in Oregon. Appendix E - one of the functional appendices - is based on data contained in the three supporting Appendices, A through C. Its purpose is to outline action that might be taken to ameliorate increasing flood damages due to continuing development in the Basin. The present status of the Basin's flood problems is assessed by studying flood characteristics, flood areas, and flood damages. Ongoing flood damage programs, both structural and non-structural, are reviewed. Future demands are outlined through a presentation of projected flood plain development. Projected damage reductions are discussed. Future problems are inventoried; these include shortages of suitable dam sites, use conflict, levees, local cooperation, regulation of flood plain use, flood forecasting, and evacuation of flood control storage. Alternatives are presented for each of 11 subbasins. Both structural and non-structural measures are studied. The study concludes that flood damage reduction can be achieved, both by providing for such structural measures as flood control storage, levees, and channel stabilization and improvement; and by providing for non-structural measures, such as improved watershed management, flood plain regulation, and flood forecasting. Two addenda present potential flood control storage sites in the Basin and projected potential flood damages and damage-reduction benefits. (See also W79-08433) (Zayac-NC)
W79-08438

WILLAMETTE BASIN COMPREHENSIVE STUDY OF WATER AND RELATED LAND RESOURCES: APPENDIX K--RECREATION,
Pacific Northwest River Basins Commission, Portland, OR. Willamette Basin Task Force.
For primary bibliographic entry see Field 6B.
W79-08444

6G. Ecologic Impact Of Water Development

ENVIRONMENTAL REQUIREMENTS AND POLLUTION TOLERANCE OF TRICHOPTERA,
Purdue Univ., Lafayette, IN. Dept. of Entomology.
T. L. Harris, and T. M. Lawrence.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-290 321, Price codes: A14 in paper copy, A01 in microfiche. Report No. EPA-600/4-78-063, November 1978. 316 p, 1 fig, 245 tab, 289 ref. R803319.

Descriptors: *Aquatic insects, *Caddisflies, *Aquatic habitats, *Aquatic environment, Biology, Diet, Life cycles, Larvae, Distribution, Distribution patterns, Alkalinity, Nitrates, Temperature, Ammonia, Phosphorus, Nitrites, Toxicity, Heavy metals, Bioindicators.

Profiles for 245 taxa of North American Trichoptera are compiled from available information to serve in evaluating data collected for the assessment of water quality. The profiles include the following parameters: life stage, general habitat, specific habitat, retreat, diet, turbidity, current, temperature, pH, dissolved oxygen, alkalinity, nitrates, nitrites, ammonia, phosphorus (ortho and total), seasonal distribution, and geographical distribution. The ranges for these parameters are given where possible. When available, parameters such as toxic compounds, heavy metals, and pesticides are included. (Davison-IPA)
W79-08156

PROBABLE WALLEYE (STILOSTEDION VITREUM) HABITATION IN THE SNAKE RIVER AND TRIBUTARIES OF IDAHO,
Idaho Univ., Moscow. Water Resources Research Inst.
D. H. Bennett.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-297 983, Price codes: A04 in paper copy, A01 in microfiche. Research Technical Completion Report, April 1979. 48 p, 4 fig, 1 tab, 70 ref. OWRT A-060-IDA(1). 14-34-0001-8014.

Descriptors: *Walleye, *Fish behavior, *Fish diets, *Fish migration, *Fish populations, Ecological distribution, Lentic environment, Lotic environment, Snake River(Idaho), Columbia River(Washington), Publications.

The walleye, an important sport and commercial fish species in Eastern and Central North America, is well known throughout its native and introduced range as a voracious predator inhibiting lentic and lotic ecosystems. Extensive drainage systems in the Pacific Northwest create an opportunity for wide distribution within a watershed when introductions are made. The presence of walleye in the Lower Snake River has aroused concern over possible expansion of its populations into the upper Snake, Clearwater and Salmon river systems which have historically produced large runs of anadromous fishes. Walleye could intensify predation on emigrating juvenile salmonids, further contribution to the decline of anadromous fish in Idaho. The historic impact of walleye on salmonid fishes is reviewed. Data on the occurrence and abundance of walleye in the Snake and Columbia rivers is documented. Literature on the walleye is plentiful in published and unpublished sources, and a bibliography containing 107 listings is provided. (Davison-IPA)
W79-08167

INVESTIGATION OF THE EFFECTS OF CONSTRUCTION AND STAGE FILLING OF RESERVOIRS ON THE ENVIRONMENT AND ECOLOGY: PREPROJECT BASELINE,
Construction Engineering Research Lab., Champaign, IL.
R. E. Riggins, and J. R. Anderson.
Prepared for Goddard Space Flight Center, Greenbelt, MD, May 1977. 38 p, 18 fig, 2 append, 10 tab. S-53875.

Descriptors: *Reservoir construction, *Water sources, *Reservoir stages, *Reservoir silting, *Salt River(MO), *Missouri, *Clarence Cannon Dam(MO), Land use, Regional planning, Ecology, Environmental effects, Remote sensing, Aerial photography, Vegetation effects(Cover), Satellites, Landsat imagery, Aircraft imagery.

The purpose of this report is to develop a preproject environmental baseline so that environmental changes that occur during construction and operation of an inland reservoir can be identified. This project is the second of a series of investigations designed to measure changes in the ecology of a river basin using high-altitude aerial and satellite imagery. The project is the Clarence Cannon Dam and Reservoir located on the Salt River in northeastern Missouri, Multi-seasonal landsat images were used to record preproject environmental conditions, especially land cover characteristics. The report presents landsat images of the land cover at various stages of the year using alternative processing methods. The grid-cell mapping and dual-image mapping techniques are described and the results of each technique in accurately determining land cover are presented. Aircraft imagery was obtained during this study for use in analyzing the project area and then comparing its usefulness with landsat imagery. Two levels of analysis were pursued; a regional scale analysis, and a more detailed study analysis. Both levels are described and illustrated to show how the aircraft imagery can be used for environmental monitoring and establishment of baseline information. The anticipated physical and biological impacts of an inland reservoir are summarized. (Coan-NC)
W79-08179

STRATEGIES FOR RESERVING FLOWS FOR FISH AND WILDLIFE: IDENTIFICATION, DESCRIPTION, AND PRELIMINARY EVALUATION,
Dewsnup (Richard L.)/Dallin W. Jensen, Salt Lake City, UT.
For primary bibliographic entry see Field 6E.
W79-08401

THE CONFLICT OVER THE NEW RIVER AND THE TEST CASE FOR THE WILD AND SCENIC RIVERS ACT (COMMENT ON NORTH CAROLINA V. FPC),
North Carolina Central Univ., Durham.
For primary bibliographic entry see Field 6E.
W79-08418

EFFECTS OF VARIOUS IRRIGATION SCHEDULES ON POPULATION DENSITIES OF BANKS GRASS MITE AND ITS PREDATORY ARTHROPODS IN CORN, THE TEXAS HIGH PLAINS,
Texas Agricultural Experiment Station, College Station.
L. D. Chandler, C. R. Ward, W. M. Lyle, and E. D. Dynum.
Report No. PR 3443 C, April 1977, 17 p, 6 tab, 16 ref.

Descriptors: *Insect control, *Scheduling, *Mites, *Irrigation effects, *Irrigation practices, *Crop response, Pest control, Integrated control measures, Environmental effects, Arthropods, Crop production, Corn, Sorghum, Soil moisture, Texas High Plains.

Since its first major outbreak in 1967, the Banks grass mite (Oligonychus pratensis) has become a major problem to corn and sorghum producers on the Texas High Plains. Apparently favoring the dry hot climatic conditions of this area, mite populations have shown high mortality in the past due to prolonged rainfall, so specified irrigation rates in conjunction with seasonal climatic conditions have been suggested as possible methods of control. Considering this possibility of non-chemical control methods, the present corn irrigation study, using different irrigation treatments, was initiated during the 1976 growing season at the Texas A & M Agricultural Research Station at Halfway. Pioneer 3369-A hybrid corn was planted April 20 at a rate of 32,000 plants per acre and eight row-irrigation treatments with three replicates were arranged in randomized block statistical design. Threatments tested included: (1) an alternate row irrigation on a 1-2 week schedule, (2) an every row irrigation on a 3-4 week schedule, (3) an alternate irrigation using the same schedule as treatment 2, and treatments 4-8) consisted of scheduled irrigation rates based on available soil moisture. Mite populations were sampled weekly beginning June 29 from the center 2 rows of each plot and classified by number of females and other beneficial arthropods. Results indicated (1) the use of irrigation scheduling can be effective as a mite control method, (2) soil moisture measuremnts can be a good indicator of needed irrigation at different plant stages, and (3) irrigation coupled with seasonal rainfall and predators can adequately check mite increases. (Tickes-Arizona)
W79-08422

THE WILLAMETTE BASIN COMPREHENSIVE STUDY OF WATER AND RELATED LAND RESOURCES: MAIN REPORT,
Pacific Northwest River Basins Commission, Portland, OR. Willamette Basin Task Force.
For primary bibliographic entry see Field 4A.
W79-08433

WILLAMETTE BASIN COMPREHENSIVE STUDY OF WATER AND RELATED LAND RESOURCES: APPENDIX A--STUDY AREA.
Pacific Northwest River Basins Commission, Portland, OR. Willamette Basin Task Force.
For primary bibliographic entry see Field 4C.
W79-08434

WILLAMETTE BASIN COMPREHENSIVE STUDY OF WATER AND RELATED LAND RESOURCES: APPENDIX B--HYDROLOGY,
Pacific Northwest River Basins Commission, Portland, OR. Willamette Basin Task Force.
For primary bibliographic entry see Field 2A.
W79-08435

WILLAMETTE BASIN COMPREHENSIVE STUDY OF WATER AND RELATED LAND RESOURCES: APPENDIX D-- FISH AND WILDLIFE,
Pacific Northwest River Basins Commission, Portland, OR. Willamette Basin Task Force.
For primary bibliographic entry see Field 8I.
W79-08437

WILLAMETTE BASIN COMPREHENSIVE STUDY OF WATER AND RELATED LAND RESOURCES: APPENDIX G- LAND MEASURES AND WATERSHED PROTECTION.
Pacific Northwest River Basins Commission, Portland, OR. Willamette Basin Task Force.
For primary bibliographic entry see Field 4D.
W79-08440

PRINCIPLES FOR LOCAL ENVIRONMENTAL MANAGEMENT,
For primary bibliographic entry see Field 6E.
W79-08467

MANAGEMENT OF WETLANDS FOR WILDLIFE HABITAT IMPROVEMENT,
Louisiana State Univ., Baton Rouge. School of Forestry and Wildlife Management.
For primary bibliographic entry see Field 2I.
W79-08470

RIVER PLANTS: THE MACROPHYTIC VEGETATION OF WATERCOURSES,
Cambridge Univ. (England). Botany School.
For primary bibliographic entry see Field 2I.
W79-08482

THE NATURAL ENVIRONMENTS OF GEORGIA,

Georgia State Univ., Atlanta.
For primary bibliographic entry see Field 2I.
W79-08484

THE ENVIRONMENTAL IMPACT OF AGRICULTURE IN ETHIOPIA,
Helsinki Univ. (Finalnd).
A. Kuru.
Environmental Conservation, Vol. 5, No. 3, p 213-220, Autumn 1978, 3 fig, 2 tab, 6 ref.

Descriptors: *Environmental effects, *Environmental control, *Erosion, *Limiting factors, *Comprehensive planning, Ecosystems, Agroclimatology, Crop response, Productivity, Vegetation effects, Social aspects, Water resources development, Arid lands, Ethiopia, Livestock, Water supply, Water shortage.

Agriculture in Ethiopia where a wide range of climatic conditions give rise to a great variety in natural vegetation types, ranging from luxuriant tropical mountain forests to absolute desert, is dependent upon water, the decisive and chief limiting factor in the growing of crops and raising of animals. This comprehensive analysis of Ethiopia's agricultural sector and its environmental impacts reveals that the country as a whole is constrained by interrelated human and ecological problems consisting of insufficient development plans, lack of protection of its resources, poor transport and communication facilities, inadequate education and an absence of technically trained manpower. These problems, their effects and possible means of improvement are elucidated by this author with emphasis upon an ecosystem approach in which actions in one area are viewed in the historical terms of the entire system. Examples include a description of the short rainy season in the arid regions where fluctuations in precipitation restrict the usefulness of pastures to a very short period of the year. Water is thus the limiting factor when herds travel long distance to drinking water which only depresses the quality of the cattle as well as increasing the hazard of erosion associated with such movements. These severe erosion problems exacerbate the constraints in the distribution and quality of water available for domestic supplies, livestock, and crops. (Tickes-Arizona)
W79-08487

WETLANDS, DRAINAGE AND LEISURE,
E. W. Dash.
Parks and Recreation (London), Vol. 42, No. 6, p 64-66, June, 1977.

Descriptors: *Wetlands, *Europe, *Conservation, Marsh management, Drainage, Productivity, Fishing.

Once thought of as monotonous expanses of wasteland fit only for reclamation and development, wetlands now not only provide many people with relief from everyday life, but also offer a wide range of active pursuits to farmers, hunters, fishermen, naturalists and tourists. These uses and the potential threats to the rest of the European wetlands made the Council for Europe's Center for Nature Conservation dedicate the year 1976 to the conservation and management of wetlands. (Steiner-Mass)
W79-08489

7. RESOURCES DATA

7A. Network Design

PRINCIPLES FOR LOCAL ENVIRONMENTAL MANAGEMENT,
For primary bibliographic entry see Field 6E.
W79-08467

7B. Data Acquisition

AN INEXPENSIVE TENSIOMETER FOR SNOW-MELT RESEARCH,
Department of the Environment, Ottawa (Ontario). Inland Waters Directorate.
For primary bibliographic entry see Field 2C.
W79-08114

A STUDY OF SEVERAL PRESSURE RIDGES AND ICE ISLANDS IN THE CANADIAN BEAUFORT SEA,
Gulf Oil Canada Ltd., Calgary (Alberta).
For primary bibliographic entry see Field 2C.
W79-08121

CALCULATION OF EVAPORATION DURING THE THREE STAGES OF SOIL DRYING,
Science and Education Administration, Phoenix, AZ. Water Conservation Lab.
For primary bibliographic entry see Field 2D.
W79-08138

ELECTROLYTIC METHOD FOR MEASURING FLOW VELOCITY,
N. V. Pikush.
Soviet Hydrology: Selected Papers, Vol. 16, No. 3, p 254-255, 1977. 3 fig, 2 ref. Translated from Hydraulic Engineering and Reclamation (Gidrotekhnika i melioratatsiya) No. 5, p 51-53, 1977.

Descriptors: *Flow measurement, *Methodology, *Instrumentation, *Flowmeters, Velocity, Testing procedures, Average flow, Measurement, Canals, Channels, Electrolytes, Sodium chloride, Conductivity, Ions, Current meters, Electrodes, Salt velocity method.

The electrolytic method examined is simple and very accurate. It can be applied only in straight reaches of canals and channels of the same form, where water movement is uniform. The method consists of simultaneously introducing an electrolyte into the flow and measuring the variations in the electrical conductivity of the water in the flow at two gaging stations lying downstream. The first experimental measurements of average flow velocity by the electrolyic method were performed in the main canal of the Trubezh irrigation system at Baryshevka village. The average velocity determined by this method from the peak of electrical conductivity and the center of the cloud was found to vary from 0.0344 to 0.035 m/sec in two experiments, while that obtained as the ratio of the discharge taken from the discharge curve to the cross section area of the water was found to be 0.035 m/sec. Subsequently, numerous measurements made in various canals and rivers confirmed the high accuracy of the proposed method. It is particularly advisable to use the electrolytic method where current meters are unusable for various reasons. (Humphreys-ISWS)
W79-08144

INVESTIGATION OF THE EFFECTS OF CONSTRUCTION AND STAGE FILLING OF RESERVOIRS ON THE ENVIRONMENT AND ECOLOGY: PREPROJECT BASELINE,
Construction Engineering Research Lab., Champaign, IL.
For primary bibliographic entry see Field 6G.
W79-08179

GROUNDWATER SOURCES LOCATED BY FRACTURE TRACE TECHNIQUE,
Pennsylvania State Univ., University Park. School of Forest Resources.
For primary bibliographic entry see Field 2G.
W79-08338

TENSIOMETERS AND IRRIGATION SCHEDULING,
Fruit and Fruit Technology Research Inst., Stellenbosch (South Africa).
For primary bibliographic entry see Field 4B.
W79-08362

BENTHIC DETRITUS IN A SALTMARSH TIDAL CREEK,
Virginia Univ., Charlottesville. Dept. of Environmental Studies.
For primary bibliographic entry see Field 2I.
W79-08478

REMOTE SENSING OF COASTAL WETLAND VEGETATION AND ESTUARINE WATER PROPERTIES,
Delaware Univ., Newark. Coll. of Marine Studies.
V. Klemas.
In: Estuarine Processes, Volume II, Circulation, Sediments, and Transfer of Material in the Estuary, M. Wiley, editor, Academic Press, New York, N.Y., 1976, p 381-403. 11 fig, 2 tab, 53 ref.

Descriptors: *Remote sensing, *Wetlands, *Estuaries, Coasts, Vegetation, Pollutants, Currents(Water), Suspended solids, Satellite(Artificial), Maps.

Photo-interpretation of aircraft and satellite imagery with the aid of 'ground truth' is illustrated employing both direct visual and automated computer techniques. Specific applications include mapping wetland vegetation and coastal land use, monitoring natural and man-induced changes in the coastal zone, charting current circulation and determining the type and concentration of suspended matter in coastal waters. Imaging suspended matter or other subsurface features is more difficult than mapping surface slicks or land use because of complex mixing, scattering and absorption processes in the water column. For some applications, it is shown that an integrated boat-aircraft-satellite approach can produce better results or cast less than the deployment of large numbers of boats or field teams without remote sensor support. (Stihler-Mass)
W79-08481

7C. Evaluation, Processing and Publication

SIX-MINUTE RAINFALL INTENSITY DATA FOR AN EXCEPTIONALLY HEAVY TROPICAL RAINSTORM,
Queensland Dept. of Forestry, Atherton (Australia).
For primary bibliographic entry see Field 2B.
W79-08123

INVESTIGATION OF THE EFFECTS OF CONSTRUCTION AND STAGE FILLING OF RESERVOIRS ON THE ENVIRONMENT AND ECOLOGY: PREPROJECT BASELINE,
Construction Engineering Research Lab., Champaign, IL.
For primary bibliographic entry see Field 6G.
W79-08179

PREDICTION OF DRAINAGE DENSITY FROM SURROGATE MEASURES,
Hull Univ. (England). Dept. of Geography.
K. S. Richards.
Water Resources Research, Vol. 15, No. 2, p 435-442, April 1979. 7 fig, 5 tab, 22 ref.

Descriptors: *Drainage density, *Watersheds(Basins), *Measurement, Geomorphology, Geology, Maps, Channels, Analysis, Equations, Sampling, *Surrogate measures, Surrogate indices, Line-sampling methods, Shreve segments.

A number of surrogate indices have been proposed as alternatives to, or predictors of, drainage density. These involve quadrat- and line-sampling methods, which avoid the problems of watershed definition and irregular area measurement, and counts of segments, junctions, and sources, which avoid measurement of irregular line lengths. These techniques were evaluated, and the number of Shreve segments within a quadrat-sampling unit was found to be consistently the best predictor of both quadrat and basin drainage density, although differences occur according to the nature of network definition (blue line or contour crenulated). A number of tests of the suggested prediction relationships were described, and these indicated that the method can successfully predict drainage densities in areas other than the area for which the

relationship is derived and on different map editions at the same scale. (Lee-ISWS)
W79-08265

A SCREENING MODEL FOR PLAN FORMULATION IN SOUTHEASTERN NEW ENGLAND, VOLUME 1, PART I – IV,
Massachusetts Inst. of Tech., Cambridge. Dept. of Civil Engineering.
For primary bibliographic entry see Field 6B.
W79-08271

A SCREENING MODEL FOR PLAN FORMULATION IN SOUTHEASTERN NEW ENGLAND, PART V: PERSPECTIVES AND TOOLS FOR COPING WITH SOCIOTECHNICAL ENGINEERING SYSTEMS,
Massachusetts Inst. of Tech., Cambridge. Dept. of Civil Engineering.
For primary bibliographic entry see Field 6B.
W79-08272

A SCREENING MODEL FOR PLAN FORMULATION IN SOUTHEASTERN NEW ENGLAND, PART VI: LAND USE CAPABILITY MAPPING,
Massachusetts Inst. of Tech., Cambridge. Dept. of Civil Engineering.
For primary bibliographic entry see Field 6B.
W79-08273

WATER-RESOURCES INVESTIGATIONS OF THE U.S. GEOLOGICAL SURVEY IN COLORADO--FISCAL YEAR 1979,
Geological Survey, Lakewood, CO. Water Resources Div.
D. E. Hillier.
Geological Survey open-file report 79-402, March 1979. 101 p, 33 fig, 1 plate, 1 tab.

Descriptors: *Water resources, *Colorado, *Surface waters, *Groundwater, *Water quality, Basic data collection, Projects, Maps, Colorado River basin, Missouri River basin, Arkansas River basin, Rio Grande basin.

Water-resources data-collection activities for October 1, 1978, through September 30, 1979, are summarized for Colorado and bordering States. Forty-nine interpretive hydrologic investigations include: 6 statewide investigations, 5 regional investigations, 10 investigations in the Missouri River basin, 8 investigations in the Arkansas River basin, 3 investigations in the Rio Grande basin, 15 investigations in the Colorado River basin, and 2 multistate investigations. The summaries of the investigations consist of maps showing the location of the areas of investigations and a brief description of the investigation's purpose, objective, approach, progress, and plans. (Woodard-USGS)
W79-08382

WATER RESOURCES DATA FOR MISSOURI, WATER YEAR 1977,
Geological Survey, Rolla, MO. Water Resources Div.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-287 604, Price codes: A13 in paper copy, A01 in microfiche. Geological Survey Water-Data Report MO-77-1, August 1978. 277 p, 3 fig.

Descriptors: *Missouri, *Hydrologic data, *Surface waters, *Groundwater, *Water quality, Gaging stations, Streamflow, Flow rates, Sediment transport, Water analysis, Water temperature, Chemical analysis, Lakes, Reservoirs, Water wells, Water levels, Data collections, Sites.

Water resources data for the 1977 water year for Missouri consist of records of stage, discharge, and water quality of streams; stage, contents, and water quality of lakes and reservoirs; and water quality of ground water. This report contains discharge records for 122 gaging stations; stage records for 3 of these gaging stations; contents for 6 lakes and reservoirs; and water quality for 21 gaging stations, 11 partial-record stations, 1 lake and 3 wells. Also included are data for 99 crest-stage partial-record stations. These data represent that part of the National Water Data System operated by the U.S. Geological Survey and cooperating State and Federal agencies in Missouri. (Woodard-USGS)
W79-08383

WATER RESOURCES DATA FOR PUERTO RICO, SURFACE AND QUALITY-OF-WATER RECORDS, WATER YEARS 1975-76, GROUND WATER RECORDS, WATER YEARS 1973-76,
Geological Survey, Ft. Buchanan, PR. Water Resources Div.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-296 415, Price codes: A17 in paper copy, A01 in microfiche. Geological Survey Water-Data Report PR-76-1, December 1978. 366 p, 19 fig, 3 tab. 25 ref.

Descriptors: *Puerto Rico, *Hydrologic data, *Surface waters, *Groundwater, *Water quality, Gaging stations, Streamflow, Flow rates, Sediment transport, Water analysis, Water temperature, Chemical analysis, Lakes, Reservoirs, Water wells, Water levels, Data collections, Sites.

Water resources data for surface water and quality-of-water-records for 1975-76 water years and ground water for 1973-76 water years for Puerto Rico consist of records of stream discharge, water quality of streams, and water levels of wells. This report contains discharge and water-quality records for 34 gaging stations, 86 water-quality stations, and 47 miscellaneous water-quality stations; and water levels for 50 observation wells. Also included are data for 16 crest-stage partial-record stations. These data represent that part of the National Water Data System operated by the U.S. Geological Survey and the National Water Data System operated by the U.S. Geological Survey and the Commonwealth of Puerto Rico. (Woodard-USGS)
W79-08390

HYDROGEOLOGIC FEATURES OF THE ALLUVIAL DEPOSITS IN THE GREYBULL RIVER VALLEY, BIGHORN BASIN, WYOMING,
Geological Survey, Cheyenne, WY. Water Resources Div.
M. E. Cooley, and W. J. Head.
Geological Survey Water-Resources Investigations 79-6 (open-file report), 1979. 38 p, 3 fig, 2 plates, 7 tab, 13 ref.

Descriptors: *Groundwater resources, *Wyoming, *Aquifer characteristics, *Water yield, *Water quality, Water wells, Alluvial aquifers, Hydrogeology, Surface-groundwater relationships, Rocky Mountain region, Streamflow, Water yield, Groundwater recharge, Flood plains, Irrigation, Chemical analysis, Maps, *Bighorn Basin(WY), *Greybull River Valley(WY).

The alluvial aquifer along the Greybull River in Wyoming, consists principally of the Greybull terrace doposits and flood-plain alluvium but also includes Burlington terrace deposits east of Burlington, the McKinnie terrace, and the younger, generally undissected alluvial-fan deposits. Well-log data and 18 surface-resistivity measurements at four localities indicate that the thickness of the alluvial aquifer is as much as 60 feet thick only near Burlington and Otto. The most favorable area for development of ground water from the alluvial aquifer is near Burlington and Otto where relatively large amounts of water can be obtained from the Greybull terrace deposits and the flood-plain alluvium. Elsewhere, the deposits of the alluvial aquifer yield only small amounts of water to wells. (Woodard-USGS)
W79-08391

WATER RESOURCES OF THE NORTHERN UINTA BASIN AREA, UTAH AND COLORADO, WITH SPECIAL EMPHASIS ON GROUND-WATER SUPPLY,
Geological Survey, Salt Lake City, UT. Water Resources Div.
J. W. Hood, and F. K. Fields.
Utah Department of Natural Resources Technical Publication No. 62, 1978. 75 p, 20 fig, 5 plates, 9 tab, 44 ref.

Descriptors: *Groundwater resources, *Surface-groundwater relationships, *Aquifer characteristics, *Available water, *Water quality, River basins, Water wells, Withdrawal, Water yield, Water supply, Water utilization, Surface waters, Flow rates, Maps, Utah, Colorado, *Uinta Basin area.

During 1971-74, hydrologic studies were made in a 5,200 square-mile area of the Unita Basin and Uinta Mountains. The principal sources of water are precipitation and trans-basin inflow through the Green and White Rivers, which for the period 1941-70 annually averaged 4.87 million acre-feet and 3.55 million acre-feet, respectively. Of the water from precipitation within the area, 190,000 acre-feet was exported annually and 440,000 acre-feet entered the Green River. The ground-water system is in unconsolidated and consolidated rocks. Gross recharge is estimated to be 500,000 acre-feet, of which 200,000 acre-feet returns to streams in the upland areas. Withdrawals by man have not changed the amount of ground water in storage significantly. Fresh to slightly saline water in storage amounts to an estimated 28 million acre-feet. Approximately 160,000 acre-feet is consumed by evapotranspiration, 12,000 acre-feet is consumed by man, and 128,000 acre-feet is discharged to streams. During high flow, all streams are fresh; during low flow, water at the mouths of some tributaries is slightly to moderately saline. Ground water ranges from fresh to briny. Fresh to slightly saline water can be obtained from at least one aquifer in about two-thirds of the area. (Woodard-USGS)
W79-08395

THE OLIGOCENE AQUIFER SYSTEM IN MISSISSIPPI,
Geological Survey, Jackson, MS. Water Resources Div.
L. A. Gandl.
Geological Survey Water-Resources Investigations 79-28 (open-file report), 1979. 2 sheets, 5 fig, 3 tab, 23 ref.

Descriptors: *Groundwater resources, *Mississippi, *Aquifer characteristics, *Water quality, *Water levels, Maps, Water wells, Water yield, Hydrogeology, Water analysis, Chemical analysis, Water utilization, *Oligocene aquifer system, Forest Hill Sand, Byram Formation, Mariana limestone, Vicksburg group.

The Oligocene aquifer system in Mississippi consists of limestone and marl members of the Vicksburg Group, and the underlying Forest Hill Sand. The aquifer system crops out in a band 5 to 10 miles wide, that trends southeast across the State from the Warren-Yazoo County line to northeastern Wayne County. In the northwest part of the area, the formations dip to the southwest at 12 feet per mile. At the southeastern end of the outcrop, the dip is 42 feet per mile. The average dip for the entire area is 30 feet per mile. The aquifers are of primary importance for domestic and farm use. Total withdrawal in 1977 was about 1.4 million gallons per day. Since 1963 water levels have declined an average of between 0.05 and 2 feet per year. Water quality is generally good although in some places there are objectionably high concentrations of iron and color. (Woodard-USGS)
W79-08399

PRINCIPLES FOR LOCAL ENVIRONMENTAL MANAGEMENT,
For primary bibliographic entry see Field 6E.
W79-08467

8. ENGINEERING WORKS

8A. Structures

DEVELOPMENT AND APPLICATION OF SEDIMENT BASINS IN MARYLAND,

Soil Conservation Service, College Park, MD.
For primary bibliographic entry see Field 2J.
W79-08006

PROTOTYPE SPILLWAY PERFORMANCE VERIFICATION,
Science and Education Administration, Minneapolis, MN. St. Anthony Falls Hydraulic Lab.
For primary bibliographic entry see Field 8B.
W79-08092

QUASISTATIC RESPONSE OF OFFSHORE STRUCTURES USING PROBABILISTIC METHODS,
Liverpool Univ. (England). Dept. of Civil Engineering.
R. Burrows.
Applied Mathematical Modelling, Vol. 1, No. 6, p 325-332, September 1977. 6 fig, 1 tab, 39 equ, 16 ref, 2 appen.

Descriptors: *Offshore structures, *Probability, *Wave loading, *Hydraulics, *Statistical methods, Mathematical models, Systems analysis, Equations, Design, Gaussian process, Morison's equation, Multivariate pdf, Linear structures, First-order wave theory, Quasistatic response.

Recent research has developed probabilistic descriptions of wave loading on short sections of offshore structure members subject to random wave loading. These descriptions include both short and long term distributions of loading and their peak and extreme values, a knowledge of which is required for the structural design of members. Unfortunately, such a single component of loading is inadequate to effectively model all but the simplest of structural members and an extension of the probabilistic techniques is required to describe structural response, such as stress or deformation, for systems of a large number of loading components. For structures not subject to high dynamic response, there is evidence that the quasistatic response variables are distributed with a similar form to the wave loading, which, in the short term and in the absence of uni-directional currents, is fully described by its second and fourth statistical moments. This paper derives expressions for these moments of the response variables which then enables a similar treatment of response as has been applied to the loading on short sections of structural members. A simple example of a possible application of the method is included. (Bell-Graf--Cornell)
W79-08208

MORE AND BETTER USES COULD BE MADE OF BILLIONS OF GALLONS OF WATER BY IMPROVING IRRIGATION DELIVERY SYSTEMS: DEPARTMENT OF AGRICULTURE AND THE INTERIOR,
Comptroller General of the United States, Washington, DC.
E. B. Staats.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-271 739, Price codes: A04 in paper copy, A01 in microfiche. Report to Congress No. CED-77-117, September 2, 1977. 52 p, 4 fig, 3 append.

Descriptors: *Water conservation, *Canal seepage, *Water loss, *Government finance, *Interagency cooperation, *Irrigation efficiency, *Irrigation, *Conveyance structures, Conduits, Concrete-lined canals, Governments, Irrigation programs, Water delivery, Water utilization, Bureau of Reclamation.

Opportunities to better administer the Federal programs providing funds for water conveyance system improvements are discussed. To conserve current supplies, seepage losses from irrigation conveyance systems should be reduced. Although reports and studies stressed the importance of the seepage problem and identified the potential benefits of water saved by improving conveyance systems, further analyses are needed to identify and determine the overall basinwide effects of system improvements and areas where additional Federal participation would promote the national interest. Throughout the West where the seepage problem exists, water is supplied by Federal projects to about one-fifth of the total irrigated land, so that cooperation between local, State, and Federal agencies is required to lessen seepage. Reasons demonstrating the need for such cooperation are cited. A program designed to facilitate this cooperation would include the following: improved accuracy of reported seepage data; consideration of overall basinwide effects of improving conveyance systems; and identification of and solutions to institutional and legal constraints hindering improvements to water conveyance systems. (Davison-IPA)
W79-08353

THE CONFLICT OVER THE NEW RIVER AND THE TEST CASE FOR THE WILD AND SCENIC RIVERS ACT (COMMENT ON NORTH CAROLINA V. FPC),
North Carolina Central Univ., Durham.
For primary bibliographic entry see Field 6E.
W79-08418

8B. Hydraulics

PROTOTYPE SPILLWAY PERFORMANCE VERIFICATION,
Science and Education Administration, Minneapolis, MN. St. Anthony Falls Hydraulic Lab.
C. L. Anderson, and F. W. Blaisdell.
Journal of the Hydraulics Division, American Society of Civil Engineers, Vol. 105, No. HY6, Proceedings Paper 14639, p 707-720, June 1979. 11 fig, 2 ref, 2 append.

Descriptors: *Spillways, *Hydraulic structures, *Inlets(Waterways), *Model studies, Hydraulic models, Flow, Hysteresis, Structures, Drops(Structures), On-site investigations, Simulation analysis, Hydraulics.

The flow performance of a prototype closed conduit spillway which could not be explained analytically was verified by a physical model. During the falling stage of the outflow from the reservoir, full conduit flow was observed in the Marsh Creek spillway, even though the pool level was below the spillway crest. Engineers inspecting the spillway could not explain the flow performance. A physical model of the prototype was built and tested to verify the prototype performance. Tested with open and closed air vents, the model demonstrated the hysteresis shown in the falling limb of the prototype head-discharge relationship and the siphon-regulated flow observed in the prototype. Model observations indicated that the prototype flow control problem is the result of inadequate venting of the covered-top drop inlet. (Sims-ISWS)
W79-08092

HYDRAULIC RESISTANCE OF ARTIFICIAL STRIP ROUGHNESS,
Birmingham Univ. (England). Dept. of Civil Engineering.
D. W. Knight, and J. A. Macdonald.
Journal of the Hydraulics Division, American Society of Civil Engineers, Vol. 105, No. HY6, Proceedings Paper 14635, p 675-690, June 1979. 10 fig, 1 tab, 19 ref, 2 append.

Descriptors: *Roughness(Hydraulic), *Flow resistance, *Laboratory tests, *Open channel flow, Model studies, Hydraulic models, Mathematical models, Turbulence, Flow, Boundary processes, Boundaries(Surfaces), Hydraulics, Shear, Reynolds number, Roughness coefficient, Fluid friction, Fluid mechanics, Boundary shear.

An experimental study of two-dimensional flow over non-uniform roughness was reported in which artificial strip roughness was employed. The roughness elements were square in cross section and placed at different relative spacings. A six-fold classification system was suggested based upon the ideas of Morris and Adachi. Resistance data from other investigators also were considered, and the variation of resistance coefficient with Reynolds number, relative spacing, and relative depth were examined. The general resistance parameter, X, first introduced by Sayre and Albertson was found to be particularly helpful in synthesizing the various sets of resistance data. Logarithmic resistance equations involving X were validated over a wide range of roughness wavelength to height ratio. The relationship between roughness height and Nikuradse's equivalent sand roughness size was also examined. (Sims-ISWS)
W79-08093

A PROBABILISTIC MODEL FOR A RANDOMLY EXCITED FLOW,
Cairo Univ., Giza (Egypt). Dept. of Mechanical Engineering.
Y. K. Gayed, M. R. Haddara, and A. H. A. Baghdadi.
Applied Mathematical Modelling, Vol. 1, No. 6, p 299-309, September 1977. 9 fig, 1 tab, 66 equ, 11 ref, 2 append.

Descriptors: *Probability, *Mathematical models, *Hydroelectric plants, *Surge tanks, *Unsteady flow, *Stationary response, *Extreme values, Load variation, Gate valve opening, Stochastic signal, Penstocks, Pipes, Conservation equations, Euler equation of motion, Continuity equation, Systems analysis, *Hydraulics.

The deterministic approach to the construction of mathematical models for solving the problem of load fluctuation in hydro-electric power plants has been the subject of considerable investigation. Means of mitigating adverse effects, by use of surge tanks or otherwise, has received equal attention. In fact, the load demand on an electric power plant is never regular; consequently load variation may be subject to random effects. The present work concerns a probabilistic model of the random problem, whose solution gives the distribution and probability density functions of the variables involved, namely the pressures, velocities and surge tank oscillation. Order statistical methods were also used to estimate the probability of occurrence of extreme head fluctuations. (Bell-Graf--Cornell)
W79-08207

8C. Hydraulic Machinery

UPSURGE AND SPEED-RISE CHARTS DUE TO PUMP SHUTDOWN,
Donsky Engineering Co., Denver, CO.
B. Donsky, R. M. Byrne, and P. E. Bartlett.
Journal of the Hydraulics Division, American Society of Civil Engineers, Vol. 105, No. HY6, Proceedings Paper 14637, p 661-674, June 1979. 11 fig, 6 ref, 2 append.

Descriptors: *Centrifugal pumps, *Unsteady flow, *Pipe flow, *Design criteria, Hydraulic machinery, Pumps, Water hammer, Discharge lines, Analytical techniques, Mathematical models, Theoretical analysis, Hydraulics, Flow, Flow characteristics, Fluid friction, Fluid mechanics, Discharge lines, Pump speed changes, Power shutdown, Pump characteristics.

Radial (centrifugal) pumps can limit and reduce the reverse flow as the pump speeds up in reverse after power shutdown. This may cause head rises at the pump and along the discharge line. Usually, the amplitude of these upsurges with either an increase in 2 rho, or with an increase in K(2L/a) for a constant 2 rho, in which rho = the pipeline characteristic parameter; 2L/a = the round trip wave travel time; and K is a pump constant. This paper presented results of an analytical study that show that both the maximum reverse speed rise and the maximum head rise at the pump increase with an increase in K(2L/a) up to some value of K(2L/a) for each 2 rho. However, as K(2L/a) increases beyond this value, both the maximum head rise and speed rise decrease. In addition, the effect of friction on head changes in the line was presented. The results were presented in the form of charts that can be used to assist in the design of pump discharge systems providing there has been no fluid column separation. (Humphreys-ISWS)
W79-08091

FLOW CONTROL ALGORITHMS FOR YUMA DESALTING PLANT,
Bureau of Reclamation, Denver, CO. Electric Power Branch.
S. C. Stitt.
Report No. REC-ERC-78-11. December 1978. 39 p, 16 fig, 1 tab, 3 ref.

Descriptors: *Flow control, *Computer programs, *Algorithms, Digital computers, Valves, Automatic control, Desalination apparatus, Water treatment, Pre-treatment(Water), Proportional-integral-derivative(PID), Yuma(Arizona).

A programmable master supervisory control system is proposed for the Yuma Desalting Plant. Required control and data acquisition functions will be performed through minicomputer remotes. There are three requirements for the basic control function which is the flow control system: the algorithm monitors valve flow only, the valve motors will be fixed-speed motors, and the algorithm must be a general one, adaptable to different valve characteristics and travel times. Two algorithms were developed; they are discussed and contrasted. The simpler proportion control algorithm (proportional-integral-derivative, or PID) takes up less memory to implement, but does not easily accommodate the nonlinearities of the valve. The predictor/corrector algorithm can account for some nonlinearities; also, it cuts down on the pulsing of the motor, which the PID relies on to obtain slower motor speeds. The PID algorithm would work well in flow control situations where constant head changes are taking place and relatively few set-point changes occur. The predictor/corrector is desirable in situations where there are few head changes; the added accuracy, efficiency, and adaptability afforded by it are worth the additional complexity of the algorithm. Included are flow charts, and definitions of timing and interface requirements. (Schaefer-IPA)
W79-08356

8D. Soil Mechanics

PUMP OUT TEST IN ALLUVIAL SANDS,
Central Building Research Inst., Roorkee (India).
A. Singh, G. S. Jain, and V. S. Aggarwal.
Transactions of Indian Society of Desert Technology and University Centre of Desert Studies, Vol. 2, No. 2, p 171-176, Dec 1977, 7 fig, 2 tab, 4 ref.

Descriptors: *Permeability, *Sands, *Aquifer characteristics, *Soil physical properties, *Alluvium, *Pumping, *Groundwater movement, Soil horizons, Stratification, Piezometers, Water table, Correlation analysis, Clays, India, Testing procedures.

Presented here is an account of a pump out test conducted to determine the in-situ permeability of alluvial sands for designing a dewatering scheme at the site of the atomic power plant at Narora, India. Borings up to a depth of about 60 M at the site which is situated on the right bank of the Ganga River about 5 KM down stream from the Narora Barrage indicated a predominately sandy deposit with layers of clayey soil at two different depths. These layers were interspersed with sand layers, and the groundwater table, located about 10 M below ground level, was observed to fluctuate only within a range of about 1.75 M. A fully or partially penetrating well and a number of piezometers were arranged on 3 tiers preferably 120 degrees to each other. Water levels were recorded after every hour with a simple electrical dip gauge. A similar technique was used to measure the water table in each of the 14 piezometers, and well discharge was measured for each determination of water table position. Results indicated that the coefficient of permeability as determined by these field tests agreed closely with empirical correlations for poorly graded uniform sands although empirical correlation with well graded sand deposits was found to give unreliable values. It is suggested that field tests can be minimized in number on poorly graded uniform sands. (Tickes-Arizona)
W79-08027

8E. Rock Mechanics and Geology

DETERMINATION OF THE BASEMENT COMPLEX CONFIGURATION IN THE SAFFORD VALLEY, ARIZONA, BY BOUGUER GRAVITY ANOMALY TECHNIQUES,
Paris-6 Univ. (France). Lab. de Geologie Dynamique.
A. B. Muller.
Journal of the Arizona Nevada Academy of Science, Vol. 13, No. 1, p 3-6, Feb. 1978, 2 fig, 7 ref.

Descriptors: *Geological surveys, *Gravimetric analyses, *Bouguer Gravity Anomaly techniques, *Geologic formations, Geologic investigations, On-site investigations, Geologic mapping, Geomorphology, Geophysics, Data collection, Safford Valley, Wells, Bedrock, Arizona.

Described is the determination of the basement complex configuration of the Safford Valley in Graham County, Arizona, by indirect geophysical techniques of gravimetry and gravimetric interpretation to better understand the vertical extent of fill material in this valley. The Safford Valley, approximately 30 miles long and an average 12 miles wide, runs along the Gila River, its only perennial water course. Actual depth to valley fill bedrock interface is not generally known, since few wells along the margins of the valley have intercepted the interface, and wells as deep as 3767 feet have not reached bedrock. Gravimetric data collected by students in the summer of 1972 and supplemented by USGS data were reduced to reflect actual gravitation and plotted and contoured for 214 selected stations on a Bouguer Gravity Anomaly Map. A computer model used to determine the actual configuration and depth to basement complex indicated that the underlying complex of the Safford Valley roughly conforms in slope to the non-burred portions of the complex. The gentle slope of the Gila Mountains and the relatively steep slope of the Pinaleno Mountains toward the axis of the valley intersect along a trough on the southern side of the western limb of the valley. This trough, probably reaching depths of 5200 ft., does not propagate into the eastern limb where the basement complex dips primarily along the axis of the minor limb in the direction of the northern side of the complex in the major limb. The underlying structure does not appear to conform to the bend in the river and the Safford Valley appears to be a deep block faulted structural trough forming a repository for extensive detrital fill. (Tickes-Arizona)
W79-08369

IMPACT OF CLIMATIC CHANGE ON AN ARID WATERSHED: NAHAL YAEL, SOUTHERN ISRAEL,
Arizona Univ., Tucson. Dept. of Geosciences; and Hebrew Univ., Jerusalem (Israel). Dept. of Geography.
W. B. Bull, and A. P. Schick.
Quaternary Research, Vol. 11, p 153-171, 1979, 12 fig, 3 tab, 18 ref.

Descriptors: *Geohydrologic units, *Hydrogeology, *Geomorphology, Geologic history, *Dating, *History, *Geologic time, Geologic formations, Slopes, Fluvial sediments, Pleistocene epoch, Geophysics, Israel, Deserts, Recent epoch, Colluvium, Sediment transport.

To assess the impact of climatic change on the geomorphic processes of an extremely arid fluvial system, data from the Nahal Yael drainage basin and adjacent small Nahel Naomi in the southern Negev and Sinai were examined. Observations of precipitation, streamflow, erosion and deposition in the area have been made over the last decade. The climatic geomorphology shows that thin grassy colluvium, once covering the lower portions of the granite hillslopes in the late Pleistocene, is now completely stripped, causing marked contrasts in outcrop morphologies. Previously mantled slopes are now smooth and crumbly, lacking desert varnish, while previously unmantled slopes are rough, craggy, and varnished, but little weathered. This suggests a change from semiarid to a drier and/or warmer climate. Responding to climatically-induced changes in water discharge and hill-slope sediment, the stream subsystem experienced increased sediment yields, producing valley alluviation in the early Holocene, and a decrease in sediment yield later, causing entrenchment of the valley fill. More granite and amphibolite gravel-size particles are presently transported than when the hillslopes were extensively mantled, and dense networks of trails, uncommon in Holocene geomorphic surfaces, are present in remnants of Pleistocene surfaces. (Tickes-Arizona)
W79-08373

8I. Fisheries Engineering

EGG DEPOSITION OF THE DESERT PUPFISH, CYPRINODON MACULARIUS, IN RELATION TO SEVERAL PHYSICAL PARAMETERS,
California State Dept. of Fish and Game, Rancho Cordova; and California Univ., Davis. Div. of Wildlife and Fisheries Biology.
L. A. Courtois, and S. Hino.
California Fish and Game, Vol. 65, No. 2, p 100-105, 1979, 2 tab, 1 fig, 9 ref.

Descriptors: *Fish eggs, *Fish behavior, *Fish conservation, *Fish management, *Desert pupfish, *Endangered species, *Aquatic environment, *Fish reproduction, Aquatic productivity, Environmental effects, Spawning, Salinity, Depth, California wildlife conservation.

Although various aspects of artificial propagation of the Desert Pupfish (Cyrinodon macularius) have been extensively studied, egg production has been limited in all of these studies because pairs of pupfish (one male and one female) were used in each tank. The present study examines reproduction of groups of pupfish, rather than pairs in relation to color of spawning substrate, salinity, and water depth. Fish used for experimentation were collected from canals around the Salton Sea, California, during January 1975, transported to the laboratory and subjected to various experiments designed to provide further understanding of environmental influences on the reproductive biology of this species. Results indicated that fish acclimated to 50/00 salinity deposited more eggs, usually in the deepest portion (37 cm) of their tank than fish acclimated to 150/00 salinity who utilized the intermediate depth (22 cm) of their tank for deposition significantly more than other available depths, color preference studies indicated that green spawning mops were more frequently used than gray, green or beige. (Tickes-Arizona)
W79-08371

WILLAMETTE BASIN COMPREHENSIVE STUDY OF WATER AND RELATED LAND RESOURCES: APPENDIX D-- FISH AND WILDLIFE,
Pacific Northwest River Basins Commission, Portland, OR. Willamette Basin Task Force.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A036 749, Price codes: A15 in paper copy, A01 in microfiche. Chaired by the Bureau of Sport Fisheries and Wildlife, 1969, 290 p, 84 tab, 13 fig 11 maps.

Descriptors: *Fish management, *Wildlife management, *Watershed management, *Wildlife conservation, *Fish, *Willamette River(OR), *Wildlife, *River basin development, Oregon, Ecology, Environmental effects, Fish conservation, Dams, Fish establishment, Fish farming, Fish migration, Fish reproduction, Fisheries, Water policy, Fish stocking, Fish hatcheries, Habitat improvement, Big game, Game birds, Non-game birds, Environmental management, Non-migratory birds, Water birds, Furbearers, Mammals, Small animals(Mammals), Reasonable use, Planning, River basins.

This study was undertaken to plan for the proper development of water and related land resources of the Willamette River Basin in Oregon. Appendix D is based on data contained in the three supporting appendices, A through C, and is also

specifically related to some of the other functional appendices. Its purpose is to examine fish and wildlife aspects of the Willamette Basin and develop recommendations which will adequately provide for preservation and improvement of these resources. Resource utilization, effects of settlement and development, and legal and administration regulations are first assessed. This discussion lays the groundwork for a review of the Basin's present use of fish and wildlife resources. Each subbasin of the study area is discussed, followed by a basin-wide inventory and distribution review of big game, upland game, waterfowl, furbearers, predators, and fish. In a section dealing with future demands, projected demands for fish and projected supplies of fish are presented. In a corresponding review of wildlife, hunting pressures, effects of water development projects, and wildlife projections are studied. In discussing alternatives for fish and wildlife management, the cases for improved streamflows, habitat improvement, improved access, propagation, and better programs and projects are made. The study concludes with recommendations for an improved resource management strategy. (See also W79-08433) (Zayac-NC)
W79-08437

10. SCIENTIFIC AND TECHNICAL INFORMATION

10D. Specialized Information Center Services

IDENTIFICATION CODES FOR ORGANIZATIONS LISTED IN COMPUTERIZED DATA SYSTEMS OF THE U.S. GEOLOGICAL SURVEY,
Geological Survey, Reston, VA. Water Resources Div.
M. D. Edwards, and B. M. Myers.
Geological Survey open-file report 79-331, 1979. 80 p, 1 fig, 2 ref.

Descriptors: *Data storage and retrieval, *Information exchange, *Organizations, Indexing, Data transmission, *Organization identification code, Computerized data systems, *U.S. Geological Survey, National Water Data Exchange(NAWDEX).

This report contains codes for the identification of public and private organizations listed in computerized data systems. These codes are used by the U.S. Geological Survey's National Water Data Exchange (NAWDEX), National Water Data Storage and Retrieval System (WATSTORE), National Cartographic Information Center (NCIC), and Office of Water Data Coordination (OWDC). The format structure of the codes is discussed and instructions are given for requesting new codes. (Woodard-USGS)
W79-08386

10F. Preparation Of Reviews

SNOW ACCUMULATION, DISTRIBUTION, MELT, AND RUNOFF,
Army Terrestrial Sciences Center, Hanover, NH.
For primary bibliographic entry see Field 2C.
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Toxic Substances in the Effluents of Petrochemical Plants and Their Effect on Aquatic Organisms (Review),
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The Accumulation of Heavy Metals in the Submerged Plant (Elodea Nuttallii),
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Use of Ground Water for the Development of Rajasthan Desert,
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MANITOBA UNIV., WINNIPEG. DEPT. OF ZOOLOGY.
Iodine Balance in Rainbow Trout (Salmo gairdneri) and Effects of Testosterone Propionate,
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MARINE BIOLOGICAL LAB., WOODS HOLE, MA. BOSTON UNIV. MARINE PROGRAM.
Assimilation of Sewage by Wetlands,
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MARINE BIOLOGICAL LAB. WOODS HOLE, MA. ECOSYSTEMS CENTER.
Effect of Petroleum Hydrocarbons on Microbial Populations in an Arctic Lake,
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Effects of DDT and PCB's on Survival of Lake Trout Eggs and Fry in a Hatchery and in Lake Michigan, 1973-1976,
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Influence of Aquatic Macrophytes on the Chemistry of Skadar Lake, Yugoslavia,
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A Comparison of Pump Sampling Systems for Live Zooplankton Collection,
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Flexible Multilayer Tubular Structure for Irrigation and Process for Its Preparation,
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